DRAFT FEDERAL CONSENSUS GUIDANCE FOR THE PREPARATION OF QUALITY ASSURANCE PROJECT PLANS

IDQTF, Version 4

October 2000

FOREWORD

This document contains two major sections. Section 1 consists of the Quality Assurance Project Plan (QAPP) Compendium, which provides an overview of policies for project-specific environmental data collection efforts conducted at or on Federal facilities. Section 2 consists of the Quality Assurance Project Plan Manual, which provides detailed guidance for implementing the policies for environmental data collection efforts at or on Federal facilities. Section 2 is divided into four parts, each of which addresses the major elements of a QAPP: Project Management and Objectives, Measurement/Data Acquisition, Assessment/Oversight, and Data Verification/Validation and Usability. In addition, Section 2 provides worksheets that can be used to address required parts of the Manual and to prepare QAPPs.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF DIAGRAMS (SECTION 2)

LIST OF FIGURES (SECTION 2)

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

Page

LIST OF TABLES (SECTION 2)

LIST OF APPENDICES

ACRONYMS

AA - Atomic Absorption
BOD - Biochemical Oxygen Demand
CA - Corrective Action
CAA - Clean Air Act
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLP - Contract Laboratory Program
COC - Contaminants of Concern
CRDL - Contract-Required Detection Limit
CWA - Clean Water Act
DOT - Department of Transportation
DQA - Data Quality Assessment
DQIs - Data Quality Indicators
DQOs - Data Quality Objectives
EMMC - Environmental Monitoring Management Council
EPA - Environmental Protection Agency
ERA - Environmental Risk Assessment
FID - Flame Ionization Detector
FIFRA - Federal Insecticide, Fungicide, and Rodenticide Act
FS - Feasibility Study
GC - Gas Chromatograph
GC/MS - Gas Chromatography/Mass Spectrometry
GPC - Gel Permeation Chromatography
IATA - International Air Transport Association
ICP - Inductively Coupled Plasma
IPA - Initial Precision and Accuracy
IS - Internal Standard
LCS - Laboratory Control Sample
LFB - Laboratory Fortified Blank
LIMS - Laboratory Information Management Systems
LQAP - Laboratory Quality Assurance Plan
MCLs - Maximum Contaminant Levels
MDLs - Method Detection Limits
MPC - Measurement Performance Criteria
MS/MSD - Matrix Spike/Matrix Spike Duplicate
MSR - Management Systems Review
NEIC - National Enforcement Investigations Center
NIST - National Institute of Standards and Technology
NPDES - National Pollutant Discharge Elimination System
PARCC - Precision, Accuracy, Representativeness, Completeness, and Comparability
PCBs - Polychlorinated Biphenyls
PE - Performance Evaluation
PESs - Performance Evaluation Samples

ACRONYMS

PID - Photo Ionization Detector
PQLs - Practical Quantitation Limits
PQOs - Project Quality Objectives
pre-RI - pre-Remedial Investigation
PRP - Potentially Responsible Party
QA - Quality Assurance
QA/QC - Quality Assurance/Quality Control
QC - Quality Control
QAPP - Quality Assurance Project Plan, synonymous with QAPjP
QLs - Quantitation Limits
QMP - Quality Management Plan
RA - Remedial Action
RCRA - Resource Conservation and Recovery Act
RD - Remedial Design
RI - Remedial Investigation
RIC - Reconstructed Ion Chromatogram
RLs - Reporting Limits
RPD - Relative Percent Difference
RSD - Relative Standard Deviation
RT - Retention Time
SAP - Sampling and Analysis Plan
SA/SI - Site Assessment/Site Investigation
SD - Standard Deviation
SDG - Sample Delivery Group
SDWA - Safe Drinking Water Act
SOP - Standard Operating Procedure
SQLs - Sample Quantitation Limits
SRM - Standard Reference Material
TCLP - Toxicity Characteristic Leaching Procedure
TIC - Tentatively Identified Compound
TSA - Technical Systems Audit
TSCA - Toxic Substances Control Act
VOA - Volatile Organic Analysis
XRF - X-Ray Fluorescence Spectrometry

GLOSSARY OF QUALITY ASSURANCE AND RELATED TERMS[1]

The following glossary is from EPA QA/G-5, except where noted otherwise. The IDQTF is requesting comments on terms and on the adequacy and appropriateness of the definitions.

Acceptance criteria — Specified limits placed on characteristics of an item, process, or service defined in requirements documents. (American Society for Quality Control)

Accuracy — The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator. (U.S. EPA Quality Assurance Management Staff (QAMS), Glossary of Quality Assurance Terms, 8/31/92 and 12/6/95)

Activity — An all-inclusive term describing a specific set of operations or related tasks to be performed, either serially or in parallel (e.g., research and development, field sampling, analytical operations, equipment fabrication), that, in total, result in a product or service.

Assessment — The evaluation process used to measure the performance or effectiveness of a system and its elements. As used here, assessment is an all-inclusive term used to denote any of the following: audit, performance evaluation (PE), management systems review (MSR), peer review, inspection, or surveillance.

Audit (quality) — A systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

Bias — The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value).

Blank — A sample subjected to the usual analytical or measurement process to establish a zero baseline or background value. Sometimes used to adjust or correct routine analytical results. A sample that is intended to contain none of the analytes of interest. A blank is used to detect contamination during sample handling preparation and/or analysis.

Calibration — A comparison of a measurement standard, instrument, or item with a standard or instrument of higher accuracy to detect and quantify inaccuracies and to report or eliminate those inaccuracies by adjustments.

Certification — The process of testing and evaluation against specifications designed to document, verify, and recognize the competence of a person, organization, or other entity to perform a function or service, usually for a specified time.

Chain of custody — An unbroken trail of accountability that ensures the physical security of samples, data, and records.

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[1] **Unless otherwise noted, this glossary's definitions were taken from EPA Guidance for Quality Assurance Project Plans, EPA/600/R-98/018, February 1998 (EPA QA/G-5).**

Characteristic — Any property or attribute of a datum, item, process, or service that is distinct, describable, and/or measurable.

Comparability — A measure of the confidence with which one data set or method can be compared to another.

Completeness — A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct, normal conditions.

Configuration — The functional, physical, and procedural characteristics of an item, experiment, or document.

Conformance — An affirmative indication or judgment that a product or service has met the requirements of the relevant specification, contract, or regulation; also, the state of meeting the requirements.

Contractor — Any organization or individual contracting to furnish services or items or to perform work.

Corrective action — Any measures taken to rectify conditions adverse to quality and, where possible, to preclude their recurrence.

Data Quality Assessment (DQA) — The scientific and statistical evaluation of data to determine if data obtained from environmental operations are of the right type, quality, and quantity to support their intended use. The five steps of the DQA process include (1) reviewing the DQOs and sampling design, (2) conducting a preliminary data review, (3) selecting the statistical test, (4) verifying the assumptions of the statistical test, and (5) drawing conclusions from the data.

Data Quality Indicators (DQIs) — The quantitative statistics and qualitative descriptors that are used to interpret the degree of acceptability or utility of data to the user. The principal data quality indicators are bias, precision, accuracy (bias is preferred), comparability, completeness, representativeness.

Data Quality Objectives (DQOs) — The qualitative and quantitative statements derived from the DQO process that clarify a study's technical and quality objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Data Quality Objectives (DQO) Process — A systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use. DQOs are the qualitative and quantitative outputs from the DQO process.

Data reduction — The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collating them into a more useful form. Data reduction is irreversible and generally results in a reduced data set and an associated loss of detail.

Data usability — The process of ensuring or determining whether the quality of the data produced meets the intended use of the data.

Design — The specifications, drawings, design criteria, and performance requirements. Also, the result of deliberate planning, analysis, mathematical manipulations, and design processes.

Detection Limit (DL) — A measure of the capability of an analytical method to distinguish samples that do not contain a specific analyte from samples that contain low concentrations of the analyte; the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability. DLs are analyte- and matrix-specific and may be laboratory-dependent.

Distribution — (1) The appointment of an environmental contaminant at a point over time, over an area, or within a volume; (2) a probability function (density function, mass function, or distribution function) used to describe a set of observations (statistical sample) or a population from which the observations are generated.

Document control — The policies and procedures used by an organization to ensure that its documents and their revisions are proposed, reviewed, approved for release, inventoried, distributed, archived, stored, and retrieved in accordance with the organization's requirements.

Duplicate samples — Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method, including sampling and analysis.

Environmental conditions — The description of a physical medium (e.g., air, water, soil, sediment) or a biological system expressed in terms of its physical, chemical, radiological, or biological characteristics.

Environmental data — Any parameters or pieces of information collected or produced from measurements, analyses, or models of environmental processes, conditions, and effects of pollutants on human health and the ecology, including results from laboratory analyses or from experimental systems representing such processes and conditions.

Environmental data operations — Any work performed to obtain, use, or report information pertaining to environmental processes and conditions.

Environmental monitoring — The process of measuring or collecting environmental data.

Environmental processes — Any manufactured or natural processes that produce discharges to, or that impact, the ambient environment.

Environmental programs — An all-inclusive term pertaining to any work or activities involving the environment, including but not limited to characterization of environmental processes and conditions; environmental monitoring; environmental research and development; the design, construction, and operation of environmental technologies; and laboratory operations on environmental samples.

Environmental technology — An all-inclusive term used to describe pollution control devices and systems, waste treatment processes and storage facilities, and site remediation technologies and their components that may be utilized to remove pollutants or contaminants from, or to prevent them from entering, the environment. Examples include wet scrubbers (air), soil washing (soil), granulated

activated carbon unit (water), and filtration (air, water). Usually, this term applies to hardware-based systems; however, it can also apply to methods or techniques used for pollution prevention, pollutant reduction, or containment of contamination to prevent further movement of the contaminants, such as capping, solidification or vitrification, and biological treatment.

Estimate — A characteristic from the sample from which inferences on parameters can be made.

Field blank — A blank used to provide information about contaminants that may be introduced during sample collection, storage, and transport. A clean sample, carried to the sampling site, exposed to sampling conditions, returned to the laboratory, and treated as an environmental sample.

Field (matrix) spike — A sample prepared at the sampling point (i.e., in the field) by adding a known mass of the target analyte to a specified amount of the sample. Field matrix spikes are used, for example, to determine the effect of the sample preservation, shipment, storage, and preparation on analyte recovery efficiency (the analytical bias).

Finding — An assessment conclusion that identifies a condition having a significant effect on an item or activity. An assessment finding may be positive or negative, and is normally accompanied by specific examples of the observed condition.

Graded approach — The objective process of establishing the project requirements and level of effort according to the intended use of the results and the degree of confidence needed in the quality of the results. (IDQTF QAPP Manual Subgroup Consensus Definition)

Guidance — A suggested practice that is not mandatory, intended as an aid or example in complying with a standard or requirement.

Guideline — A suggested practice that is not mandatory in programs intended to comply with a standard.

Hazardous waste — Any waste material that satisfies the definition of hazardous waste given in 40 CFR 261, "Identification and Listing of Hazardous Waste."

Holding time — The period of time a sample may be stored prior to its required analysis. While exceeding the holding time does not necessarily negate the veracity of analytical results, it causes the qualifying or "flagging" of any data not meeting all of the specified acceptance criteria.

Inspection — The examination or measurement of an item or activity to verify conformance to specific requirements.

Internal standard — A standard added to a test portion of a sample in a known amount and carried through the entire determination procedure as a reference for calibrating and controlling the precision and bias of the applied analytical method.

Management — Those individuals directly responsible and accountable for planning, implementing, and assessing work.

Management system — A structured, nontechnical system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for conducting work and producing items and services.

Matrix spike (MS) — A sample prepared by adding a known concentration of a target analyte to an aliquot of a specific homogenized environmental sample for which an independent estimate of the target analyte concentration is available. The matrix spike is accompanied by an independent analysis of the unspiked aliquot of the environmental sample. For organics, the matrix spike is run in conjunction with a matrix spike duplicate. Spiked samples are used to determine the effect of the matrix on a method's recovery efficiency. (EPA QA/G-5 definition modified by the IDQTF Matrix Subgroup)

Mean (arithmetic) — The sum of all the values of a set of measurements divided by the number of values in the set; a measure of central tendency.

Method — A body of procedures and techniques for performing an activity (e.g., sampling, chemical analysis, quantification), systematically presented in the order in which they are to be executed.

Method blank — A blank prepared to represent the sample matrix as closely as possible and analyzed exactly like the calibration standards, samples, and quality control (QC) samples. Results of method blanks provide an estimate of the within-batch variability of the blank response and an indication of bias introduced by the analytical procedure.

Must — When used in a sentence, a term denoting a requirement that has to be met.

Nonconformance — A deficiency in a characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate; nonfulfillment of a specified requirement.

Objective evidence — Any documented statement of fact, other information, or record, either quantitative or qualitative, pertaining to the quality of an item or activity, based on observations, measurements, or tests that can be verified.

Observation — An assessment conclusion that identifies a condition (either positive or negative) that does not represent a significant impact on an item or activity. An observation may identify a condition that has not yet caused a degradation of quality.

Organization — A company, corporation, firm, enterprise, or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration.

Outlier — An extreme observation that is shown to have a low probability of belonging to a specified data population.

Parameter — A quantity, usually unknown, such as a mean or a standard deviation characterizing a population. Commonly misused for "variable," "characteristic," or "property."

Performance evaluation (PE) — A type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of an analyst or laboratory.

Pollution prevention — An organized, comprehensive effort to systematically reduce or eliminate pollutants or contaminants prior to their generation or their release or discharge into the environment.

Precision — The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (National Environmental Laboratory Accreditation Conference (NELAC), July 1998 Standards)

Procedure — A specified way to perform an activity.

Process — A set of interrelated resources and activities that transforms inputs into outputs. Examples of processes include analysis, design, data collection, operation, fabrication, and calculation.

Project — An organized set of activities within a program.

Qualified data — Any data that have been modified or adjusted as part of statistical or mathematical evaluation, data validation, or data verification operations.

Quality — The totality of features and characteristics of a product or service that bears on its ability to meet the stated or implied needs and expectations of the user.

Quality assurance (QA) — An integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item, or service is of the type and quality needed and expected by the client.

Quality Assurance Program Description/Plan — See *Quality Management Plan*.

Quality Assurance Project Plan (QAPP) — A formal document describing in comprehensive detail the necessary quality assurance (QA), quality control (QC), and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. The QAPP components are divided into four classes: (1) Project Management, (2) Measurement/Data Acquisition, (3) Assessment/Oversight, and (4) Data Validation and Usability.

Quality control (QC) — The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality. The system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring the results are of acceptable quality.

Quality control (QC) sample — An uncontaminated sample matrix spiked with known amounts of analytes from a source independent of the calibration standards. Generally used to establish intralaboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system.

Quality management — That aspect of the overall management system of the organization that determines and implements the quality policy. Quality management includes strategic planning, allocation of resources, and other systematic activities (e.g., planning, implementation, and assessment) pertaining to the quality system.

Quality Management Plan (QMP) — A formal document that describes the quality system in terms of the organization's structure, the functional responsibilities of management and staff, the lines of authority, and the required interfaces for those planning, implementing, and assessing all activities conducted.

Quality system — A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required quality assurance (QA) and quality control (QC).

Quantitation limit — The minimum concentration of an analyte or category of analytes in a specific matrix that can be identified and quantified above the method detection limit and within specified limits of precision and bias during routine analytical operating conditions.

Record (quality) — A document that furnishes objective evidence of the quality of items or activities and that has been verified and authenticated as technically complete and correct. Records may include photographs, drawings, magnetic tape, and other data recording media.

Recovery — The act of determining whether the methodology measures all of the analyte contained in a sample.

Remediation — The process of reducing the concentration of a contaminant (or contaminants) in air, water, or soil media to a level that poses an acceptable risk to human health.

Reporting limit — The lowest concentration or amount of the target analyte required to be reported from a data collection project. Reporting limits are generally greater than detection limits and are usually not associated with a probability level.

Representativeness — A measure of the degree to which data accurately and precisely represent a characteristic of a population, a parameter variation at a sampling point, a process condition, or an environmental condition.

Reproducibility — The precision, usually expressed as variance, that measures the variability among the results of measurements of the same sample at different laboratories.

Requirement — A formal statement of a need and the expected manner in which it is to be met.

Research (applied) — A process, the objective of which is to gain the knowledge or understanding necessary for determining the means by which a recognized and specific need may be met.

Research (basic) — A process, the objective of which is to gain fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications toward processes or products in mind.

Scientific method — The principles and processes regarded as necessary for scientific investigation, including rules for concept or hypothesis formulation, conduct of experiments, and validation of hypotheses by analysis of observations.

Self-assessment — The assessments of work conducted by individuals, groups, or organizations directly responsible for overseeing and/or performing the work.

Sensitivity — The capability of a method or instrument to discriminate between measurement responses representing different levels of a variable of interest.

Service — The result generated by activities at the interface between the supplier and the customer, and the supplier internal activities to meet customer needs. Such activities in environmental programs include design, inspection, laboratory and/or field analysis, repair, and installation.

Shall — A term denoting a requirement that is mandatory whenever the criterion for conformance with the specification permits no deviation. This term does not prohibit the use of alternative approaches or methods for implementing the specification so long as the requirement is fulfilled.

Specification — A document stating requirements and referring to or including drawings or other relevant documents. Specifications should indicate the means and criteria for determining conformance.

Spike — A substance that is added to an environmental sample to increase the concentration of target analytes by known amounts; used to assess measurement accuracy (spike recovery). Spike duplicates are used to assess measurement precision.

Split samples (field) — Two or more representative portions taken from one sample in the field and analyzed by different laboratories. Prior to splitting, a sample is homogenized to correct for sample inhomogeneity that would adversely impact sample data comparability. Split samples are quality control samples that are used to assess sample handling procedures from field to laboratory and to evaluate interlaboratory comparability and precision. (EPA QA/G-5 definition modified by the IDQTF QA Matrix Subgroup)

Split samples (laboratory) — Two or more representative portions taken from the same sample and analyzed by different laboratories to estimate the interlaboratory precision or variability and the data comparability. (EPA QA/G-5 definition modified by the IDQTF QA Matrix Subgroup)

Standard deviation — A measure of the dispersion or imprecision of a sample or population distribution that is expressed as the positive square root of the variance and has the same unit of measurement as the mean.

Standard Operating Procedure (SOP) — A written document that details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and that is officially approved as the method for performing certain routine or repetitive tasks.

Supplier — Any individual or organization furnishing items or services or performing work according to a procurement document or a financial assistance agreement. An all-inclusive term used in place of any of the following: vendor, seller, contractor, subcontractor, fabricator, or consultant.

Surrogate spike or analyte — A pure substance with properties that mimic the analyte of interest (organics only). Surrogates are brominated, fluorinated, or isotopically labeled compounds unlikely to be found in environmental samples. They are added to samples to evaluate analytical efficiency

by measuring recovery. (EPA QA/G-5 definition modified by the IDQTF QA Matrix Subgroup; and Contract Laboratory Program (CLP))

Technical Systems Audit (TSA) — A thorough, systematic, on-site qualitative audit of facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a system.

Traceability — The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project.

Trip blank — A clean sample of a matrix that is taken to the sampling site and transported to the laboratory for analysis without having been exposed to sampling procedures.

Validation — Confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use have been fulfilled. In design and development, validation concerns the process of examining a product or result to determine conformance to user needs.

Variance (statistical) — A measure or dispersion of a sample or population distribution.

Verification — Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. In design and development, verification concerns the process of examining a result of a given activity to determine conformance to the stated requirements for that activity.

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SECTION 1
QUALITY ASSURANCE PROJECT PLAN COMPENDIUM

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QUALITY ASSURANCE PROJECT PLAN COMPENDIUM

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

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SECTION 1
QUALITY ASSURANCE PROJECT PLAN COMPENDIUM

1.0 INTRODUCTION

The complexity of environmental data collection operations demands that a systematic process and structure for quality must be established if decision-makers are to have the necessary confidence in the quality of data that support their decisions. This process and structure must include the means to determine when the data are not fully usable and what to do about the situation if they are not. This process and structure is provided by the Quality System used by the organization conducting the environmental data operations.

The Quality Assurance Project Plan (QAPP) integrates all technical and quality aspects for the life-cycle of the project, including planning, implementation, and assessment. The purpose of the QAPP is to document planning results for environmental data operations and to provide a project-specific "blueprint" for obtaining the type and quality of environmental data needed for a specific decision or use. The QAPP documents how quality assurance (QA) and quality control (QC) are applied to an environmental data collection operation to ensure that the results obtained are of the type and quality needed and expected.

QAPPs can be of two types:

- A "project-specific QAPP" provides a QA blueprint specific to one project or task. Project-specific QAPPs are used when projects are limited in scope and time and, in general, can be considered the Sampling and Analysis Plan (SAP)/work plan for the project.

- A "generic program QAPP" is an overarching plan that describes a program's quality objectives and documents the comprehensive set of standard operating procedures (SOPs) for sampling, analysis, QA/QC, data validation, and assessment that are specific to one program or group. In contrast to the project-specific QAPP, the generic program QAPP serves as an umbrella under which project-specific tasks may be conducted over an extended period of time. Project- or task-specific information not covered by the umbrella is documented in detailed Sampling and Analysis Plans/work plans, which use the generic program QAPP as an informational reference whenever appropriate.

A QAPP must be prepared and approved for all environmental data collection operations performed by or on behalf of the U.S. Environmental Protection Agency (EPA). In addition to the QAPP requirement, a Quality System must be in place to support the development, review, approval, implementation, and assessment of environmental data collection operations. Lead organizations must develop, operate, and document their own Quality Systems to ensure that environmental data collected or compiled are of known and documented quality and are suitable for their intended use.

The ultimate success of an environmental program or project depends on the quality of the environmental data collected and used in decision-making, and this may depend significantly on the adequacy of the QAPP and its effective implementation. This planning must include the "stakeholders" (i.e., the data users, data producers, decision-makers, etc.) to ensure that all needs are defined adequately and that the planning for quality addresses the specific needs defined. While time spent on such planning may initially seem unproductive and costly, the penalty for ineffective planning is increased cost and lost time due to conflicts and extensive reworking.

For additional information, refer to *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs*, American National Standard, ANSI/ASQC E4-1994. The attached Manual is the Intergovernmental Data Quality Task Force's (IDQTF's) implementation of E4, Part B. In addition, the IDQTF's *Uniform Federal Policy for Implementing a Quality System*, which mirrors E4, requires that a QAPP be prepared.

2.0 SCOPE

The scope of this Manual covers all environmental data collection efforts conducted at or on Federal facilities.

Attachment A of this *QAPP Compendium*, the Federal Facility *Quality Assurance Project Plan Manual* (hereafter referred to as the *QAPP Manual*), provides comprehensive, detailed guidance for developing project-specific and generic program QAPPs. To facilitate review and to help ensure approval, the *QAPP Manual* requires that specific QAPP elements be addressed and that specific project information, as itemized in Table A, be included in the QAPP. Optional QAPP worksheets are provided in Appendix A of the *QAPP Manual* to help compile this critical project information. If used, all applicable worksheets can be directly incorporated into the QAPP as tables, flowcharts, diagrams, and attachments.

> The optional worksheets were taken from (and modified slightly) the EPA-NE QAPP Guidance. The IDQTF is requesting comment whether to keep their use optional or, for the sake of greater consistency, make their use mandatory.

3.0 USE OF A GRADED APPROACH

Since the content and level of detail in individual QAPPs will vary according to the work being performed and the intended use of the data, planners will want to use a **"graded approach"** when preparing QAPPs. A graded approach is the objective process of establishing the project requirements and level of effort according to the intended use of the results and the degree of confidence needed in the quality of the results. In other words, the degree of documentation, level of effort, and detail will vary based on the complexity and cost of the project. Appropriate consideration should be given to the significance of the environmental problems to be investigated, the environmental decisions to be made, and the impact on human health and the environment.

The examples currently used in the attached *QAPP Manual* are designed to support a Superfund risk assessment. These examples were chosen because they will generally be subject to the most in-depth type of planning process. However, application of the *QAPP Manual* process to a simpler project with a narrower focus is easily achieved. The stepwise procedure outlined in the Manual asks the user to simply note that certain requirements are not applicable and to fill out forms only as appropriate to the project.

4.0 STANDARD QAPP ELEMENTS

There are four basic elements that must be addressed in a QAPP (Figure A). In order to piece these interrelated elements together, and to ultimately meet project and data quality objectives, planning meetings (scoping meetings) must be held.

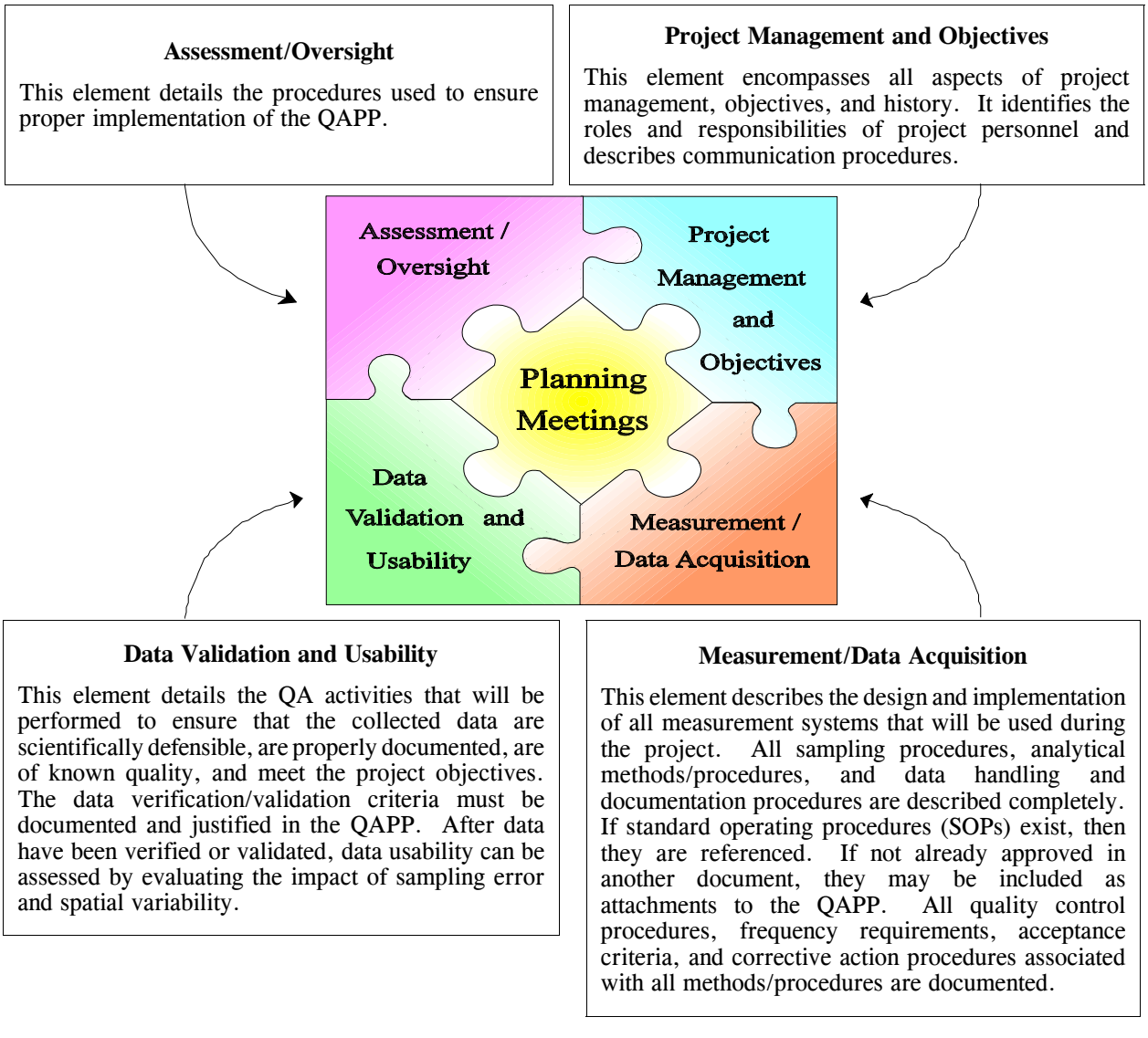

Figure A. QAPP Elements

Specific requirements for each element group are detailed in Section 2, the *QAPP Manual.*

It is recommended that generic program QAPPs and project-specific QAPPs be prepared using the format described in the attached *QAPP Manual* and titled accordingly. However, if some or all of the required QAPP elements are incorporated into other project planning documents (such as Sampling and Analysis Plans (SAPs), Field Sampling Plans (FSPs), Field Operations Plans (FOPs), Project Operations Plans (POPs), or General Project Work Plans (WPs)), then a cross-reference table similar to Table A must be provided to identify where each required QAPP element is located in the inclusive project document. The reference location must be exact and must specify the complete document title, date, section number, page numbers, and location of the information in the inclusive document. Table B provides an example of such a table using a fictitious project.

5.0 ROLES AND RESPONSIBILITIES

Lead Organization

Lead Organizations are those entities that are responsible and accountable for all phases of the environmental data collection operation. The Lead Organization may perform the project work directly or contract for field sampling, analytical services, or data validation. The Lead Organization is responsible for ensuring that organization personnel, contractors, and/or subcontractors perform project work as prescribed in the approved QAPP. The Lead Organization for environmental data collection operations, as defined by this QAPP guidance manual, will be a Federal agency. It will be either the actual entity that owns the facility or installation where the work is being done, or the EPA, exercising its oversight responsibility.

Project Manager

The Project Manager is responsible for directing and/or overseeing and coordinating all project activities for the Lead Organization. He/she is responsible for submitting QAPPs and QAPP revisions and amendments to appropriate personnel for review and approval. Refer to Figure B for an outline of the QAPP development process.

Project Team

To plan the project, the Project Manager assembles a Project Team consisting of technical personnel including data generators, QA scientists, and data users. The size of the Project Team should reflect the complexity of the project. For example, small projects may have Project Teams that consist of only two or three people.

Planning (scoping) meetings are convened to identify project and data quality objectives, decisions that must be made, project Action Limits, the type and quantity of data, and how "good" the data must be (the data quality) to ensure that the right decisions are made. The Project Team defines the quality of the data by setting acceptability limits, otherwise known as measurement performance criteria. Once the measurement performance criteria are known, the Project Team can select

sampling and analytical methods that have appropriate quantitation limits and quality control limits to achieve project objectives.

The Project Team is responsible for providing all the information required by the *QAPP Manual* and the included worksheets, even if the worksheets themselves are not used, and for resolving all technical issues prior to QAPP preparation. Ultimately, it is the responsibility of the Project Team, and not the QAPP preparer alone, to design a QA "blueprint" that meets project objectives.

QAPP Preparation Team/Writer

The QAPP should be written by a team/person that has been involved in the project planning phase and has experience or training with QAPP preparation. Members of the QAPP Preparation Team should be experienced in many aspects of environmental science, including chemistry, engineering, hydrogeology, and risk assessment. In addition, the QAPP Preparation Team should be experienced with the sample collection procedures, analytical methods, and data evaluation and assessment procedures that will be used for the project.

Project Personnel

An organizational chart must clearly show the reporting relationships between the project personnel of the lead governmental organization, including contractors and subcontractors.

All project personnel are responsible for reading and understanding applicable sections of the QAPP before beginning fieldwork. All individuals that have project responsibilities must sign a Project Personnel Sign-Off Sheet to document that they have read all relevant portions of the QAPP.

All project personnel are responsible for implementing the QAPP as prescribed.

6.0 QAPP REVIEW AND APPROVAL

Internal Review and Approval

- The QAPP should undergo internal review at all levels. The Lead Organization is responsible for ensuring that the QAPP is accurate and complete. To that end, the Lead Organization should require that organizational personnel, contractors, and subcontractors review applicable sections of the QAPP prior to submitting it to EPA or the delegated regulatory approval authority, if applicable.

External Review and Approval

- In accordance with EPA Order 5360.1 CHG 1, EPA must review and approve all intramural and extramural QAPPs before the Lead Organization begins field activities. This order specifies that the authority to review and approve QAPPs may be delegated to another organization such as a State, Tribe, or other Federal agency. Delegation of this authority by

EPA is contingent on that organization having an acceptable Quality System documented in an EPA-approved Quality Management Plan (QMP).

- All comments provided by EPA or the approval authority must be acceptably addressed in writing prior to beginning field activities. The response document (either a revised QAPP or a letter responding to specific deficiencies) should contain complete identifying information, as it is presented on the original QAPP Title and Approval Page, with updated signatures and dates. Any revisions to the original QAPP document should be identified to expedite document review and approval.

7.0 QAPP IMPLEMENTATION AND MODIFICATION

The approved QAPP must be implemented as prescribed; however, it is not intended to be inflexible or restrictive. Project-specific QAPPs and generic program QAPPs should be reviewed annually by the Lead Organization's Project Manager. Project-specific QAPPs must be kept current and must be revised whenever necessary, or when so directed by the approval authority, or at a minimum of every 5 years. Likewise, generic program QAPPs must be revised whenever necessary, or when so directed by the approval authority, or at a minimum of every 5 years.

When the original approved QAPP is altered in response to project needs, the QAPP must be amended. This amendment must be reviewed and approved in the same manner as the original QAPP. The amendment must contain complete identifying information, as presented on the original QAPP Title and Approval Page, with updated signatures and dates. Only after the amendment has been approved can the change be implemented.

Verbal approval of modifications may be obtained to expedite project work. Verbal approvals must be documented in telephone logs, which are retained in the project file. Subsequently, this verbally approved modification must be documented in an amendment to the QAPP and submitted to EPA (or other approval authority, if applicable) for signature approval.

8.0 QAPP ARCHIVAL

All QAPPs, including reviewers' comments and responses to reviewers' comments (revised QAPPs and/or response letters addressing specific issues) must be archived in the appropriate project/program file according to the procedures specified by the Lead Organization in their QAPP and/or QMP.

Project files must be retained for the period of time specified in the interagency agreement, memorandum of understanding (MOU), cooperative agreement, financial agreement, contract, or voluntary or enforcement consent decree, agreement, or order.

9.0 REFERENCES

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Web site: http://www.epa.gov/quality1/qa_docs.html

U.S. EPA, EPA Guidance for Quality Assurance Project Plans, (EPA QA/G-5) EPA/600/R-98/018, February 1998. Web site: http://www.epa.gov/quality1/qa_docs.html

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Web site: http://www.epa.gov/quality1/qa_docs.html

U.S. EPA, Region 9, Draft Laboratory Documentation Requirements for Data Validation, (9QA-07-97) July 1997. Web site: http://www.epa.gov/region09/qa/rq_qadocs.html

Intergovernmental Data Quality Task Force, Uniform Federal Policy for Implementing a Quality System, Draft, 2000.

QAPP DEVELOPMENT

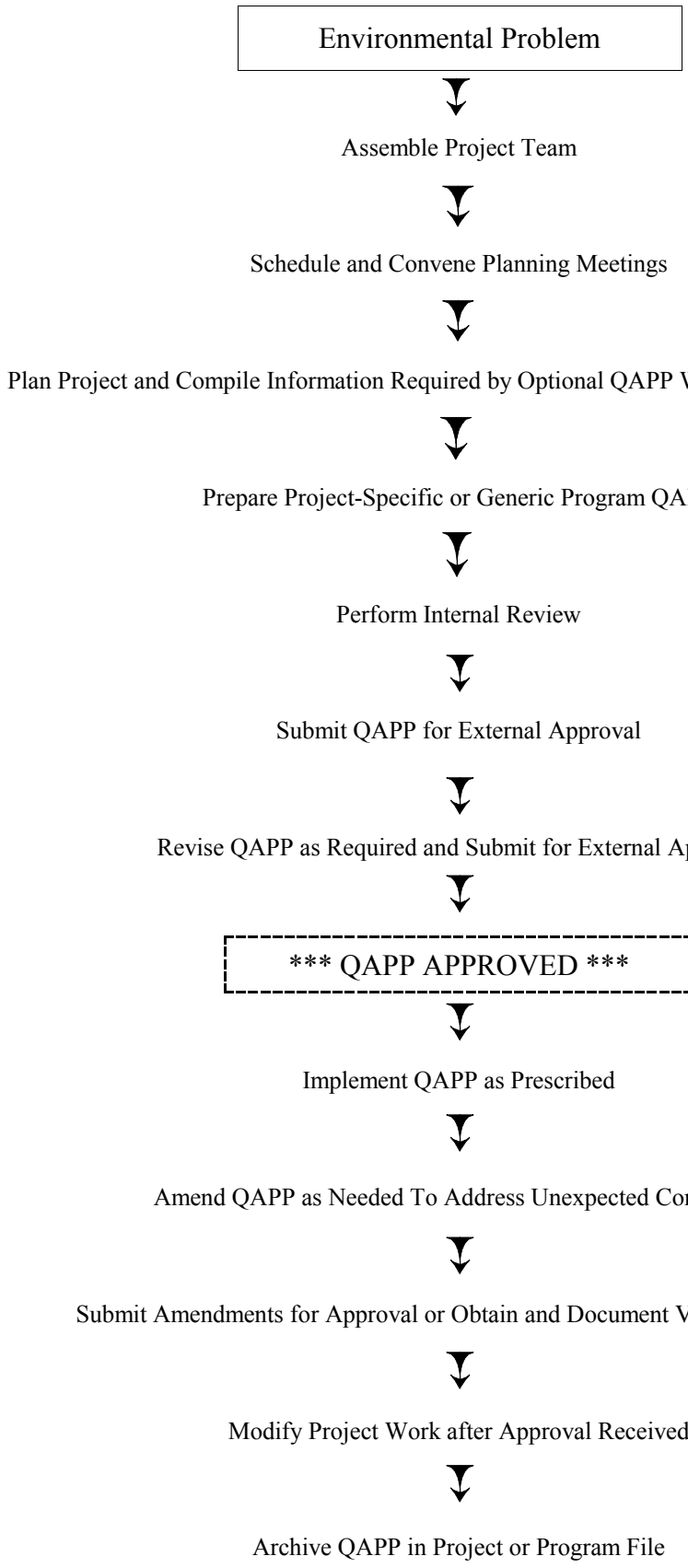

Figure B. Outline of QAPP Development

Table A. QAPP Requirement Summarization

REQUIRED QAPP ELEMENT(S) and CORRESPONDING QAPP SECTION(S)	OPTIONAL QAPP WORKSHEET #	REQUIRED INFORMATION
Project Management and Objectives		
A.1 Title and Approval Page	1	- Title and Approval Page
A.2 Table of Contents and Document Format A.2.1 Table of Contents A.2.2 Document Control Format A.2.3 Document Control Numbering System A.2.4 QAPP Identifying Information	2	- Table of Contents - QAPP Identifying Information
A.3 Distribution List and Project Personnel Sign-Off Sheet	3 4	- Distribution List - Project Personnel Sign-Off Sheet
A.4 Project Organization A.4.1 Project Organizational Chart A.4.2 Communication Pathways A.4.2.1 Modifications to Approved QAPP A.4.3 Personnel Responsibilities and Qualifications A.4.4 Special Training Requirements/ Certification	5 6 7	- Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table
A.5 Project Planning/Problem Definition A.5.1 Project Planning Meetings A.5.2 Problem Definition/Site History and Background	8	- Project Planning Meeting Documentation - Project Scoping Meeting Attendance Sheet with Agenda - Problem Definition/Site History and Background - Site Maps (historical and present)
A.6 Project Description and Schedule A.6.1 Project Overview A.6.2 Project Schedule	9a 9b 9c 9d 10	- Project Description - Contaminants of Concern and Other Target Analytes Table - Field Quality Control Sample Summary Table - Analytical Services Table - System Designs - Project Schedule Timeline Table
A.7 Project Quality Objectives and Measurement Performance Criteria A.7.1 Project Quality Objectives A.7.2 Measurement Performance Criteria	11	- Measurement Performance Criteria Table

REQUIRED QAPP ELEMENT(S) and CORRESPONDING QAPP SECTION(S)	OPTIONAL QAPP WORKSHEET #	REQUIRED INFORMATION
Measurement/Data Acquisition		
B.1.1 Sampling Process Design B.1.1.1 Sampling Design Rationale	12a 12b	- Sampling Design and Rationale - Sampling Locations, Sampling and Analysis Methods/SOP Requirements Table - Sample Location Map
B.1.2 Sampling Procedures and Requirements B.1.2.1 Sampling Procedures B.1.2.2 Sampling SOP Modifications B.1.2.3 Cleaning and Decontamination of Equipment/Sample Containers B.1.2.4 Field Equipment Calibration B.1.2.5 Field Equipment Maintenance, Testing, and Inspection Requirements B.1.2.6 Inspection and Acceptance Requirements for Supplies/Sample Containers	 13 12b 14 15	- Sampling SOPs - Project Sampling SOP Reference Table - Sampling Container, Volumes, and Preservation Table - Field Sampling Equipment Calibration Table - Cleaning and Decontamination SOPs - Field Equipment Maintenance, Testing, and Inspection Table
B.1.3 Sample Handling, Tracking, and Custody Requirements B.1.3.1 Sample Collection Documentation B.1.3.1.1 Field Notes B.1.3.1.2 Field Documentation Management System B.1.3.2 Sample Handling and Tracking System B.1.3.3 Sample Custody	 16	- Sample Handling, Tracking, and Custody SOPs - Sample Handling Flow Diagram - Sample Container Label - Chain-of-Custody Form and Seal
B.2.1 Field Analytical Method Requirements B.2.1.1 Field Analytical Methods and SOPs B.2.1.2 Field Analytical Method/SOP Modifications B.2.1.3 Field Analytical Instrument Calibration B.2.1.4 Field Analytical Instrument/ Equipment Maintenance, Testing, and Inspection Requirements B.2.1.5 Field Analytical Inspection and Acceptance Requirements for Supplies	 17 18 19	- Field Analytical Methods/SOPs - Field Analytical Method/SOP Reference Table - Field Analytical Instrument Calibration Table - Field Analytical Instrument/Equipment Maintenance, Testing, and Inspection Table

REQUIRED QAPP ELEMENT(S) and CORRESPONDING QAPP SECTION(S)	OPTIONAL QAPP WORKSHEET #	REQUIRED INFORMATION
B.2.2 Fixed Laboratory Analytical Method Requirements B.2.2.1 Fixed Laboratory Analytical Methods and SOPs B.2.2.2 Fixed Laboratory Analytical Method/SOP Modifications B.2.2.3 Fixed Laboratory Instrument Calibration B.2.2.4 Fixed Laboratory Instrument/ Equipment Maintenance, Testing, and Inspection Requirements B.2.2.5 Fixed Laboratory Inspection and Acceptance Requirements for Supplies	 20 21	- Fixed Laboratory Analytical Methods/SOPs - Fixed Laboratory Analytical Method/SOP Reference Table - Fixed Laboratory Instrument Maintenance and Calibration Table
B.3.1 Quality Control Requirements B.3.1.1 Sampling Quality Control B.3.1.2 Analytical Quality Control B.3.1.2.1 Field Analytical QC B.3.1.2.2 Fixed Laboratory QC	 22a 22b 23a 23b 24a 24b	**Sampling** - Field Sampling QC Table - Field Sampling SOP Precision and Accuracy Table **Analytical** - Field Analytical QC Sample Table - Field Analytical Method/SOP Precision and Accuracy Table - Field Screening/Confirmatory Analysis Decision Tree - Fixed Laboratory Analytical QC Sample Table - Fixed Laboratory Method/SOP Precision and Accuracy Table
B.4.1 Data Acquisition Requirements	25	- Non-Direct Measurements Criteria and Limitations Table
B.5.1 Documentation, Records, and Data Management B.5.1.1 Project Documentation and Records B.5.1.2 Field Analysis Data Package Deliverables B.5.1.3 Fixed Laboratory Data Package Deliverables B.5.1.4 Data Reporting Formats B.5.1.5 Data Handling and Management B.5.1.6 Data Tracking and Control	26	- Project Documents and Records Table - Data Management SOPs

REQUIRED QAPP ELEMENT(S) and CORRESPONDING QAPP SECTION(S)	OPTIONAL QAPP WORKSHEET #	REQUIRED INFORMATION
Assessment/Oversight		
C.1 Assessments and Response Actions C.1.1 Planned Assessments C.1.2 Assessment Findings and Corrective Action Responses C.1.3 Additional QAPP Nonconformances	27a 27b	- Assessment and Response Actions - Project Assessment Table - Audit Checklists
C.2 QA Management Reports	28	- QA Management Reports Table
Data Verification/Validation and Usability		
D.1 Verification and Validation Requirements and Procedures	29a 29b	- Data Verification/Validation Process Table - Data Verification/Validation Summary Table
D.2 Data Usability/Reconciliation with Data Quality Objectives	30	- Data Usability Assessment

Note: All OPTIONAL QAPP Worksheets, when used, should be completed with project-specific information. If the OPTIONAL QAPP Worksheets are not used, the information the worksheets require must still be presented in the QAPP. In addition, other project-specific information should be provided in tabular format, as much as practicable. However, sufficient written discussion in text format should accompany these tables. Certain sections, by their nature, will require more written discussion than others. In particular, Section B.1.1 should provide an in-depth explanation of the sampling design rationale and Sections D.1 and D.2 should describe the procedures and criteria that will be used to verify, validate, and assess data usability.

The following table provides a fictitious example of a project in which several elements of the project-specific QAPP are found in existing facility-wide project planning documents. This table cross-references the required QAPP elements with information found in inclusive documents such as basewide QAPPs, Field Sampling Plans, Sampling and Analysis Plans, and others. The presence or absence of required information in an inclusive document is not indicative of real projects.

Table B. Example Tracking of QAPP Requirements Crosswalk Between Other Project Documents

REQUIRED QAPP ELEMENT(S) and CORRESPONDING QAPP SECTION(S) IN QAPP GUIDANCE	REQUIRED INFORMATION	CROSSWALK TO RELATED DOCUMENTS
Project Management and Objectives		
A.1 Title and Approval Page	- Title and Approval Page	
A.2 Table of Contents and Document Format A.2.1 Table of Contents A.2.2 Document Control Format A.2.3 Document Control Numbering System	- Table of Contents	
A.3 Distribution List and Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	
A.4 Project Organization A.4.1 Project Organizational Chart A.4.2 Communication Pathways A.4.2.1 Modifications to Approved QAPP A.4.3 Personnel Responsibilities and Qualifications A.4.4 Special Training Requirements/ Certification	- Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	
A.5 Project Planning/Project Definition A.5.1 Project Planning Meetings A.5.2 Problem Definition/Site History and Background	- Project Planning Meeting Documentation - Project Scoping Meeting Attendance Sheet with Agenda - Problem Definition/Site History and Background - Site Maps (historical and present)	
A.6 Project Description and Schedule A.6.1 Project Overview A.6.2 Project Schedule	- Project Description - Contaminants of Concern and Other Target Analytes Table - Field and Quality Control Sample Summary Table - Analytical Services Table - System Designs - Project Schedule Timeline Table	

REQUIRED QAPP ELEMENT(S) and CORRESPONDING QAPP SECTION(S) IN QAPP GUIDANCE	REQUIRED INFORMATION	CROSSWALK TO RELATED DOCUMENTS
A.7 Data Quality Objectives and Measurement Performance Criteria A.7.1 Data Quality Objectives A.7.2 Measurement Performance Criteria	- Measurement Performance Criteria Table	Basewide QAPP, Section 3.0
Measurement/Data Acquisition		
B.1.1 Sampling Process Design B.1.1.1 Sampling Design Rationale	- Sampling Design and Rationale - Sampling Locations, Sampling and Analysis Method/SOP Requirements Table - Sample Location Map	
B.1.2 Sampling Procedures and Requirements B.1.2.1 Sampling Procedures B.1.2.2 Sampling SOP Modifications B.1.2.3 Cleaning and Decontamination of Equipment/Sample Containers B.1.2.4 Field Equipment Calibration B.1.2.5 Field Equipment Maintenance, Testing, and Inspection Requirements B.1.2.6 Inspection and Acceptance Requirements for Supplies/Sample Containers	- Sampling SOPs - Project Sampling SOP Reference Table - Sampling Container, Volumes, and Preservation Table - Field Sampling Equipment Calibration Table - Cleaning and Decontamination SOPs - Field Equipment Maintenance, Testing, and Inspection Table	Basewide QAPP, Volume 3 Approved Field Sampling Plan for ____ Base, Pages 12-18 Approved Field Sampling Plan for ____ Base, Pages 24-28 Approved Field Sampling Plan for ____ Base, Pages 32-38 Basewide QAPP, Volume 2 Approved Field Sampling Plan for ____ Base, Pages 40-43
B.1.3 Sample Handling, Tracking, and Custody Requirements B.1.3.1 Sample Collection Documentation B.1.3.1.1 Field Notes B.1.3.1.2 Field Documentation Management System B.1.3.2 Sample Handling and Tracking System B.1.3.3 Sample Custody	- Sample Handling, Tracking, and Custody SOPs - Sample Handling Flow Diagram - Sample Container Label - Chain-of-Custody Form and Seal	Basewide QAPP, Volume 1 Basewide QAPP, Volume 1 Figure 5-1, 5-2, 5-3

REQUIRED QAPP ELEMENT(S) and CORRESPONDING QAPP SECTION(S) IN QAPP GUIDANCE	REQUIRED INFORMATION	CROSSWALK TO RELATED DOCUMENTS
B.2.1 Field Analytical Method Requirements B.2.1.1 Field Analytical Methods and SOPs B.2.1.2 Field Analytical Method/SOP Modifications B.2.1.3 Field Analytical Instrument Calibration B.2.1.4 Field Analytical Instrument/ Equipment Maintenance, Testing, and Inspection Requirements B.2.1.5 Field Analytical Inspection and Acceptance Requirements for Supplies	- Field Analytical Methods/SOPs - Field Analytical Method/SOP Reference Table - Field Analytical Instrument Calibration Table - Field Analytical Instrument/Equipment Maintenance, Testing, and Inspection Table	Basewide QAPP, Volume 4 Basewide QAPP, Volume 4
B.2.2 Fixed Laboratory Analytical Method Requirements B.2.2.1 Fixed Laboratory Analytical Methods and SOPs B.2.2.2 Fixed Laboratory Analytical Method/SOP Modifications B.2.2.3 Fixed Laboratory Instrument Calibration B.2.2.4 Fixed Laboratory Instrument/ Equipment Maintenance, Testing, and Inspection Requirements B.2.2.5 Fixed Laboratory Inspection and Acceptance Requirements for Supplies	- Fixed Laboratory Analytical Methods/SOPs - Fixed Laboratory Analytical Method/SOP Reference Table - Fixed Laboratory Instrument Maintenance and Calibration Table	Basewide QAPP, Volume 5 (Organic) and Volume 6 (Metals) Basewide QAPP, Volume 5 (Organic) and Volume 6 (Metals) Basewide QAPP, Volume 5 (Organic) and Volume 6 (Metals)
B.3.1 Quality Control Requirements B.3.1.1 Sampling Quality Control B.3.1.2 Analytical Quality Control B.3.1.2.1 Field Analytical QC B.3.1.2.2 Fixed Laboratory QC	**Sampling** - Field Sampling QC Table - Field Sampling SOP Precision and Accuracy Table **Analytical** - Field Analytical QC Sample Table - Field Analytical Method/SOP Precision and Accuracy Table - Field Screening/Confirmatory Analysis Decision Tree - Fixed Laboratory Analytical QC Sample Table - Fixed Laboratory Method/SOP Precision and Accuracy Table	 Approved Field Sampling Plan for ____ Base, Pages 50-52 Approved Field Sampling Plan for ____ Base, Pages 54-58 Approved Field Sampling Plan for ____ Base, Pages 60-66 Basewide QAPP, Section 6.1, Pages 6-4 to 6-5, Table 6-2 Basewide QAPP, Section 6.2, Pages 6-8 to 6-9 Basewide QAPP, Section 6.3, Pages 6-12 to 6-14, Table 6-3 Basewide QAPP, Section 6.4, Pages 6-20 to 6-23, Table 6-4
B.4.1 Data Acquisition Requirements	- Non-Direct Measurements Criteria and Limitations Table	

REQUIRED QAPP ELEMENT(S) and CORRESPONDING QAPP SECTION(S) IN QAPP GUIDANCE	REQUIRED INFORMATION	CROSSWALK TO RELATED DOCUMENTS
B.5.1 Documentation, Records, and Data Management B.5.1.1 Project Documentation and Records B.5.1.2 Field Analysis Data Package Deliverables B.5.1.3 Fixed Laboratory Data Package Deliverables B.5.1.4 Data Reporting Formats B.5.1.5 Data Handling and Management B.5.1.6 Data Tracking and Control	- Project Documents and Records Table - Data Management SOPs	Basewide QAPP, Section 8, Page 8-2, Table 8-1 Basewide QAPP, Volume 6
Assessment/Oversight		
C.1 Assessments and Response Actions C.1.1 Planned Assessments C.1.2 Assessment Findings and Corrective Action Responses C.1.3 Additional QAPP Non-Conformances	- Assessment and Response Actions - Project Assessment Table - Audit Checklists	Basewide QAPP, Section 11.1, Page 11-2, Table 10-1
C.2 QA Management Reports	- QA Management Reports Table	
Data Validation and Usability		
D.1 Verification and Validation Requirements and Procedures	- Data Verification/Validation Process Table - Data Verification/Validation Summary Table	
D.2 Data Usability/Reconciliation with Data Quality Objectives	- Data Usability Assessment	

Note: Fictitious site created to demonstrate how to crosswalk QAPP requirements with other project documents.

SECTION 2
QUALITY ASSURANCE PROJECT PLAN MANUAL

IDQTF, VERSION 4

October 2000
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QUALITY ASSURANCE PROJECT PLAN MANUAL

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS

LIST OF DIAGRAMS

TABLE OF CONTENTS

Page

LIST OF FIGURES

TABLE OF CONTENTS (continued)

Page

LIST OF TABLES

LIST OF APPENDICES

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INTRODUCTION

This *Quality Assurance Project Plan (QAPP) Manual* is Section 2 of the *Draft Federal Consensus Guidance for the Preparation of Quality Assurance Project Plans*. It is intended to provide instructions regarding the preparation of QAPPs in accordance with *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs*, ANSI/ASQC E4 (Final, January 1995). This Manual must be used by Lead Organizations and their contractors when performing environmental data collection operations. Lead Organizations may include, but are not limited to, the following:

- U.S. Environmental Protection Agency Regions or offices.
- Other Federal Government agencies.
- States, Tribes, and local governments under financial agreements, including grants and cooperative agreements.
- Nonprofit organizations (e.g., volunteer organizations, interstate associations, etc.) under financial agreements, including institutions of higher education and hospitals.
- Regulated entities/facilities (e.g., potentially responsible parties) under voluntary or enforcement consent decrees, agreements, and orders.

Lead Organizations must develop, operate, and document Quality Systems to ensure that environmental data collected or compiled for the Agency are scientifically sound, of known and documented quality, and suitable for their intended use.

This Manual is not program-specific and is intended to be as comprehensive as possible. Since the content and level of detail in each QAPP will vary according to the work being performed and the intended use of the data, parts of this Manual may not be applicable to all programs. The information specified in Table 1 must still be provided in all QAPPs submitted to EPA or a delegated authority.

There are four basic element groups that must be addressed in a QAPP: Project Management and Objectives, Measurement/Data Acquisition, Assessment/Oversight, and Data Validation and Usability. The four QAPP element groups represent pieces of the life cycle of a project, which are integrated through the use of planning meetings (scoping meetings).

Table 1 provides a crosswalk between the QAPP elements and the required QAPP sections.

Table 1. QAPP Requirement Summarization

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S)	OPTIONAL QAPP WORKSHEET #	REQUIRED INFORMATION
Project Management and Objectives		
A.1 Title and Approval Page	1	- Title and Approval Page
A.2 Table of Contents and Document Format A.2.1 Table of Contents A.2.2 Document Control Format A.2.3 Document Control Numbering System A.2.4 QAPP Identifying Information	2	- Table of Contents - QAPP Identifying Information
A.3 Distribution List and Project Personnel Sign-Off Sheet	3 4	- Distribution List - Project Personnel Sign-Off Sheet
A.4 Project Organization A.4.1 Project Organizational Chart A.4.2 Communication Pathways A.4.2.1 Modifications to Approved QAPP A.4.3 Personnel Responsibilities and Qualifications A.4.4 Special Training Requirements/ Certification	5 6 7	- Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table
A.5 Project Planning/Problem Definition A.5.1 Project Planning Meetings A.5.2 Problem Definition/Site History and Background	8	- Project Planning Meeting Documentation - Project Scoping Meeting Attendance Sheet with Agenda - Problem Definition/Site History and Background - Site Maps (historical and present)
A.6 Project Description and Schedule A.6.1 Project Overview A.6.2 Project Schedule	9a 9b 9c 9d 10	- Project Description - Contaminants of Concern and Other Target Analytes Table - Field Quality Control Sample Summary Table - Analytical Services Table - System Designs - Project Schedule Timeline Table
A.7 Project Quality Objectives and Measurement Performance Criteria A.7.1 Project Quality Objectives A.7.2 Measurement Performance Criteria	11	- Measurement Performance Criteria Table

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S)	OPTIONAL QAPP WORKSHEET #	REQUIRED INFORMATION
Measurement/Data Acquisition		
B.1.1 Sampling Process Design B.1.1.1 Sampling Design Rationale	12a 12b	- Sampling Design and Rationale - Sampling Locations, Sampling and Analysis Methods/SOP Requirements Table - Sample Location Map
B.1.2 Sampling Procedures and Requirements B.1.2.1 Sampling Procedures B.1.2.2 Sampling SOP Modifications B.1.2.3 Cleaning and Decontamination of Equipment/Sample Containers B.1.2.4 Field Equipment Calibration B.1.2.5 Field Equipment Maintenance, Testing, and Inspection Requirements B.1.2.6 Inspection and Acceptance Requirements for Supplies/Sample Containers	 13 12b 14 15	- Sampling SOPs - Project Sampling SOP Reference Table - Sampling Container, Volumes, and Preservation Table - Field Sampling Equipment Calibration Table - Cleaning and Decontamination SOPs - Field Equipment Maintenance, Testing, and Inspection Table
B.1.3 Sample Handling, Tracking, and Custody Requirements B.1.3.1 Sample Collection Documentation B.1.3.1.1 Field Notes B.1.3.1.2 Field Documentation Management System B.1.3.2 Sample Handling and Tracking System B.1.3.3 Sample Custody	 16	- Sample Handling, Tracking, and Custody SOPs - Sample Handling Flow Diagram - Sample Container Label - Chain-of-Custody Form and Seal
B.2.1 Field Analytical Method Requirements B.2.1.1 Field Analytical Methods and SOPs B.2.1.2 Field Analytical Method/SOP Modifications B.2.1.3 Field Analytical Instrument Calibration B.2.1.4 Field Analytical Instrument/ Equipment Maintenance, Testing, and Inspection Requirements B.2.1.5 Field Analytical Inspection and Acceptance Requirements for Supplies	 17 18 19	- Field Analytical Methods/SOPs - Field Analytical Method/SOP Reference Table - Field Analytical Instrument Calibration Table - Field Analytical Instrument/ Equipment Maintenance, Testing, and Inspection Table

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S)	OPTIONAL QAPP WORKSHEET #	REQUIRED INFORMATION
B.2.2 Fixed Laboratory Analytical Method Requirements B.2.2.1 Fixed Laboratory Analytical Methods and SOPs B.2.2.2 Fixed Laboratory Analytical Method/SOP Modifications B.2.2.3 Fixed Laboratory Instrument Calibration B.2.2.4 Fixed Laboratory Instrument/ Equipment Maintenance, Testing, and Inspection Requirements B.2.2.5 Fixed Laboratory Inspection and Acceptance Requirements for Supplies	 20 21	- Fixed Laboratory Analytical Methods/SOPs - Fixed Laboratory Analytical Method/SOP Reference Table - Fixed Laboratory Instrument Maintenance and Calibration Table
B.3.1 Quality Control Requirements B.3.1.1 Sampling Quality Control B.3.1.2 Analytical Quality Control B.3.1.2.1 Field Analytical QC B.3.1.2.2 Fixed Laboratory QC	 22a 22b 23a 23b 24a 24b	**Sampling** - Field Sampling QC Table - Field Sampling SOP Precision and Accuracy Table **Analytical** - Field Analytical QC Sample Table - Field Analytical Method/SOP Precision and Accuracy Table - Field Screening/Confirmatory Analysis Decision Tree - Fixed Laboratory Analytical QC Sample Table - Fixed Laboratory Method/SOP Precision and Accuracy Table
B.4.1 Data Acquisition Requirements	25	- Non-Direct Measurements Criteria and Limitations Table
B.5.1 Documentation, Records, and Data Management B.5.1.1 Project Documentation and Records B.5.1.2 Field Analysis Data Package Deliverables B.5.1.3 Fixed Laboratory Data Package Deliverables B.5.1.4 Data Reporting Formats B.5.1.5 Data Handling and Management B.5.1.6 Data Tracking and Control	26	- Project Documents and Records Table - Data Management SOPs

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S)	OPTIONAL QAPP WORKSHEET #	REQUIRED INFORMATION
Assessment/Oversight		
C.1 Assessments and Response Actions C.1.1 Planned Assessments C.1.2 Assessment Findings and Corrective Action Responses C.1.3 Additional QAPP Nonconformances	27a 27b	- Assessment and Response Actions - Project Assessment Table - Audit Checklists
C.2 QA Management Reports	28	- QA Management Reports Table
Data Verification/Validation and Usability		
D.1 Verification and Validation Requirements and Procedures	29a 29b	- Data Verification/Validation Process Table - Data Verification/Validation Summary Table
D.2 Data Usability/Reconciliation with Data Quality Objectives	30	- Data Usability Assessment

Note: All OPTIONAL QAPP Worksheets, when used, should be completed with project-specific information. If the OPTIONAL QAPP Worksheets are not used, the information the worksheets require must still be presented in the QAPP. In addition, other project-specific information should be provided in tabular format, as much as practicable. However, sufficient written discussion in text format should accompany these tables. Certain sections, by their nature, will require more written discussion than others. In particular, Section B.1.1 should provide an in-depth explanation of the sampling design rationale and Sections D.1 and D.2 should describe the procedures and criteria that will be used to verify, validate, and assess data usability.

The QAPP serves several purposes:

- As a *technical planning document*, it provides an overview of the project by identifying the purpose of the project; defining the project quality objectives; and outlining the field, analytical, and quality assurance/quality control (QA/QC) activities that will be used to support environmental decisions.
- As an *organizational document*, it identifies key project personnel, thereby facilitating communication.
- As an *oversight document*, it must be reviewed and approved by EPA or the delegated approval authority prior to sample collection.

The QAPP serves as a demonstration of an organization's ability to plan, implement, assess and document project activities and should provide sufficient, detailed information to verify that these

activities will result in usable data. All QAPPs must, at a minimum, include all specified information and enclosures as detailed in this Manual, that is:

- **Each of the following sections (Sections A.1 through D.2) and all subsections thereof must be addressed in the QAPP to the degree appropriate for the data collection activity.** As much as practicable, information should be provided in tabular format. However, sufficient written discussion in text format should accompany those tables to facilitate understanding. Certain sections, by their nature, will require more written discussion than others. Users of this document must follow a "graded approach" when preparing QAPPs. In other words, the degree of documentation and detail will vary based on the complexity and cost of the project. Appropriate consideration should be given to the significance of the environmental problems to be investigated, the environmental decisions to be made, and the impact on human health and the environment. In some instances, documentation will consist of a concise explanation of why the particular project need not address the specified area.

- **Required QAPP enclosures/attachments, such as tables, diagrams, and documents for each section, are italicized in bold.** To assist in compiling critical QAPP information, OPTIONAL QAPP Worksheets are included in Appendix 1 and an OPTIONAL QAPP Summary Form is included in Appendix 2. These QAPP Worksheets and the QAPP Summary Form can be taken to project scoping meetings and completed during the project planning stage. Subsequently, the worksheet information can be presented in tabular format in the QAPP. The use of these worksheets is entirely optional. They are provided as a guide to the planning process. Although the worksheets are optional, the information required by the worksheets must still be presented in the QAPP.

Important Notes

1. The tables provided as examples in this Manual *are not* intended to reflect the work of just one project. In other words, project information, data, dates, objectives, etc., *will not* necessarily be consistent from one example to another.

2. The completed tables are only examples, and QAPPs must provide information and data tailored to fit the objectives of individual projects.

3. All examples are fictitious. All names, organizational names, and phone numbers are fictitious and are included for illustrative purposes only.

The overall project planning process is presented in Diagram 1. Although the overall project planning process is presented as a linear sequence of activities, project planners are advised to revisit certain planning activities whenever necessary by the iterative nature of the planning process.

The remainder of this Manual is organized in accordance with the four elements of a QAPP:

- Project Management and Objectives
- Measurement and Data Acquisition
- Assessment and Oversight
- Data Validation and Usability

Appendix 1 contains copies of optional worksheets that can be used to address required parts of the Manual and to complete your QAPP.

Request to Reviewers

The IDQTF Workgroup is actively seeking comments, including examples, as to how to better illustrate the applicability of this *QAPP Manual* to small environmental data gathering activities, such as water/wastewater. Also, the workgroup is seeking comments and examples for the applicability of this Manual to other programs, including radiological wastes and air programs.

Diagram 1. Systematic Planning Process

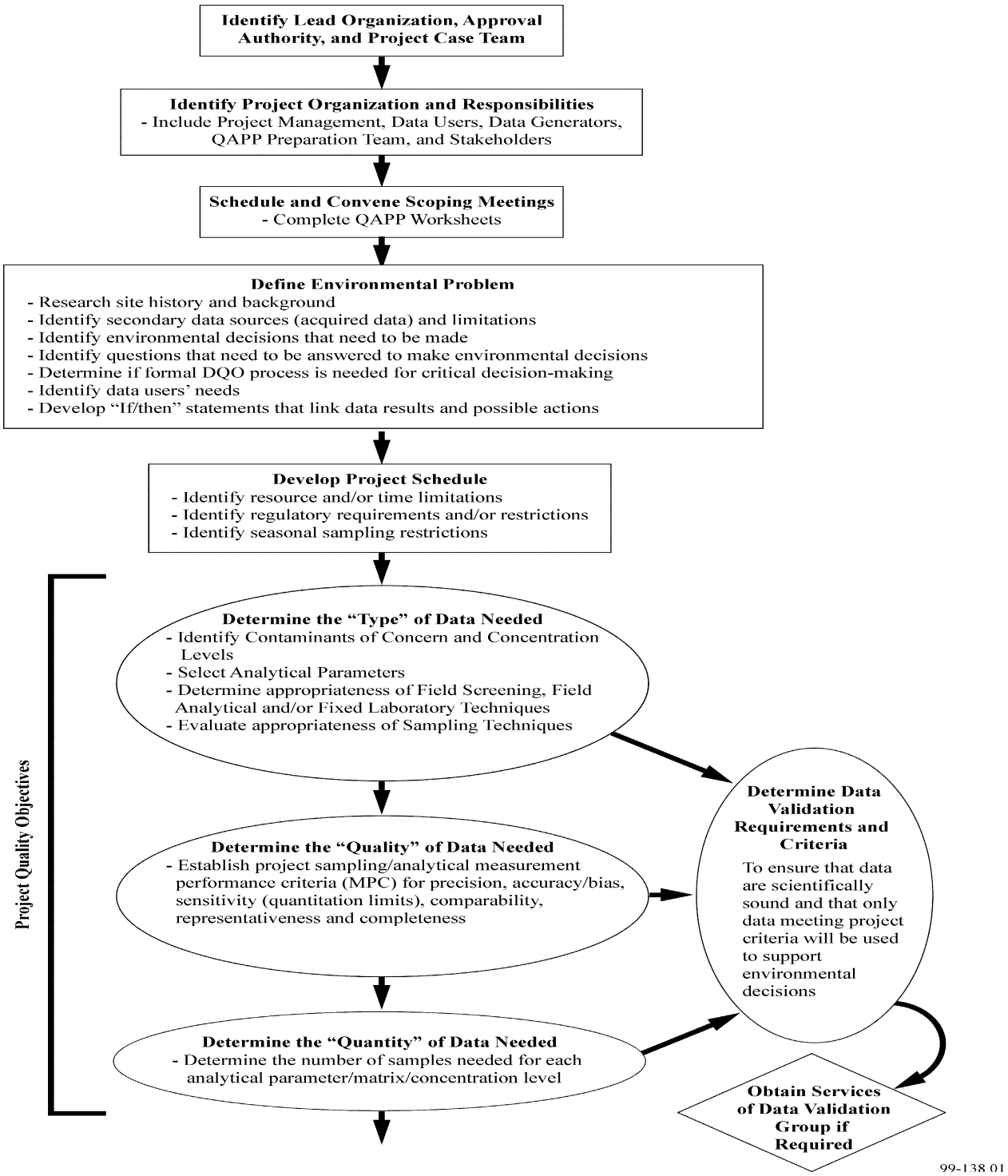
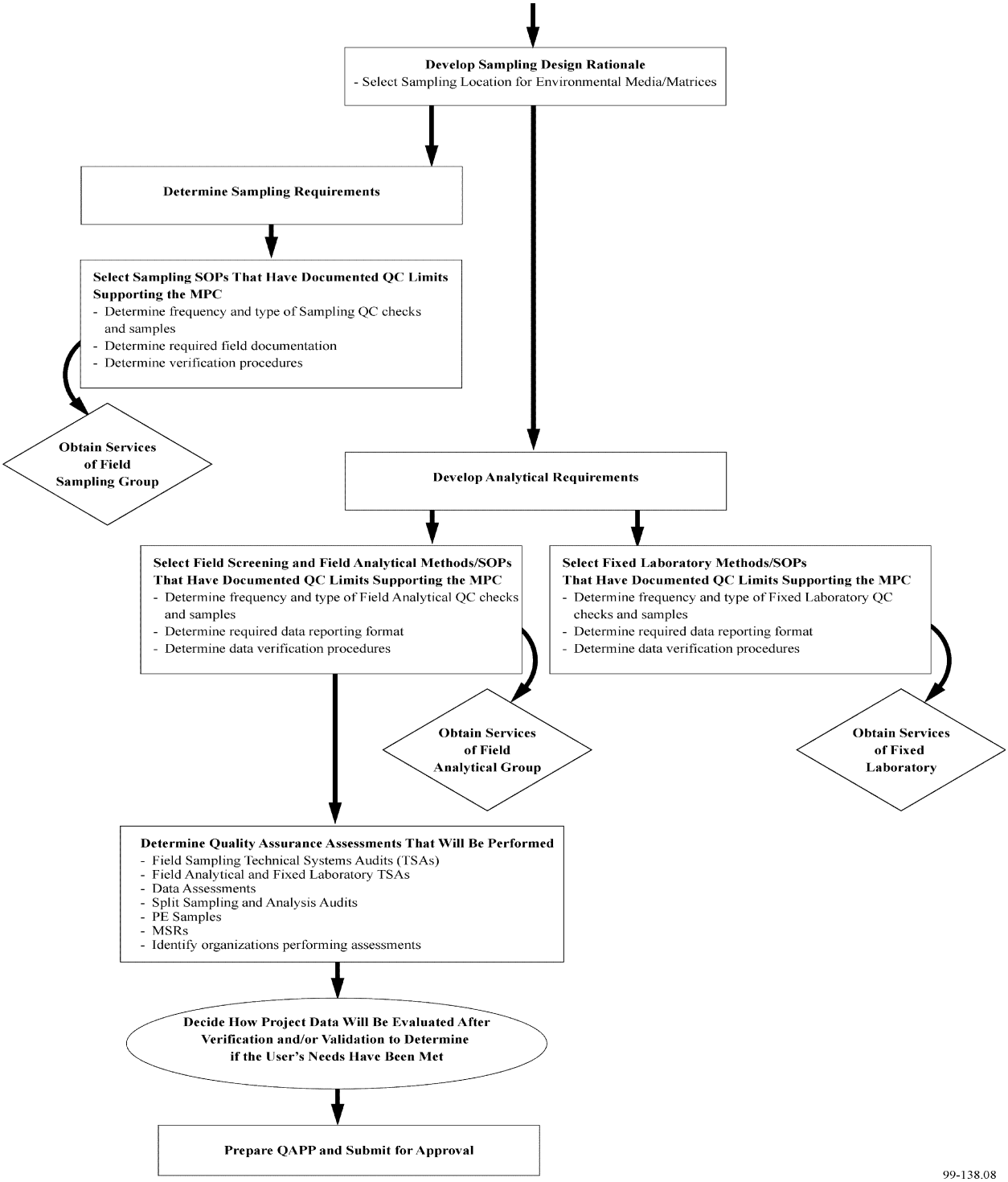


Diagram 1. Systematic Planning Process (continued)



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PART A. PROJECT MANAGEMENT AND OBJECTIVES ELEMENTS

These elements ensure that the project has a defined purpose and document the environmental problem, the environmental questions being asked, and the environmental decisions that need to be made. They identify the project quality objectives necessary to answer those questions and support those environmental decisions. These elements also address management considerations, such as roles and responsibilities, for the project.

A.1 Title and Approval Page

The Title and Approval Page is the first page of the QAPP. It documents that the QAPP has received proper approval from EPA prior to implementation.

Title and Approval Page – Provide a Title and Approval Page that contains the minimum required approvals/signatures and information as shown in OPTIONAL QAPP Worksheet #1. Though the format of this information can be different from the example in Figure 1, this information is required in the QAPP. An example of a completed Title and Approval Page is provided in Figure 1.

Figure 1. Example of Title and Approval Page

Figure 1. Example: Title and Approval Page (OPTIONAL QAPP Worksheet #1)

Site Name/Project Name: *North Street Property*
Site Location: *Wordsworth, NH*

Title: *North Street Property QAPP*
Revision Number: *1*
Revision Date: *1/9/98*
Page *12* **of** *167*

North Street Property Quality Assurance Project Plan
Document Title

Poe Recycling
Lead Organization (Agency, State, Federal Facility, PRP, or Grantee)

Eleanor Maguire/Chaucer Engineering
Preparer's Name and Organizational Affiliation

1579 Smith Street, Boston, MA 02194, (617) 957-0011
Preparer's Address and Telephone Number

1/9/98
Preparation Date (Day/Month/Year)

Investigative Organization's Project Manager: *Dorothy Parker*

Signature
Dorothy Parker/Chaucer Engineering 1/15/98
Printed Name/Organization/Date

Investigative Organization's Project QA Officer: *Claire Carpenter*

Signature
Claire Carpenter/Chaucer Engineering 1/15/98
Printed Name/Organization/Date

Investigative Lead Organization's Project Officer: *Howard Fast*

Signature
Howard Fast/Poe Recycling 1/15/98
Printed Name/Organization/Date

Approval Signatures: *Henry Thoreau*

Signature
Henry Thoreau/RCRA Facility Manager 1/25/98
Printed Name/Title/Date
EPA Region I
Approval Authority

Other Approval Signatures: *John Donne*

Signature
John Donne/EPA Region I, QA Chemist 1/25/98

Printed Name/Title/Date

Document Control Number:
FAZ115509

A.2 Table of Contents and Document Format

The organization of the QAPP should be easy to understand and must follow the format and section headings as described in this *QAPP Manual*. All italicized tables, diagrams, charts, worksheets, if used, and other deliverables, which are itemized in this Manual, must be included as components of the QAPP and listed in the Table of Contents. If any of the required QAPP elements, or other required information, are not applicable to the project, then those QAPP elements/worksheets/ required information should be indicated on OPTIONAL QAPP Worksheet #2 or some other format provided by the QAPP author, along with a justification for their exclusion. OPTIONAL QAPP Worksheet #2 (Figure 2), which will be discussed in Section A.2.4, provides an example of critical project information.

A.2.1 Table of Contents

A Table of Contents clearly outlines the organization of the QAPP and makes project information easy to reference.

Table of Contents – Provide a Table of Contents that is comprehensive and contains the title and locations (i.e., page number, appendix or attachment number, etc.) of the following items:

- Major sections
- Subsections
- References
  Applicable reference documents may include but are not limited to the following national requirement and guidance documents:
  - ANSI, Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs, American National Standard, ANSI/ASQC E4-1994.
  - Uniform Federal Policy for Implementing a Quality System, Intergovernmental Data Quality Task Force.
  - U.S. Air Force, Quality Assurance Project Plan, HQ Air Force Center for Environmental Excellence, March 1998.
  - U.S. Army Corps of Engineers, Requirements for the Preparation of Sampling and Analysis Plans, USACE EM 200-1-3.
  - U.S. Army Corps of Engineers, Technical Project Planning Guidance for HTRW Data Quality Design, USACE EM 200-1-2.
  - U.S. Army Corps of Engineers, Chemical Quality Assurance for HTRW Projects, EM-200-1-6. October 10, 1997.
  - U.S. EPA, National Enforcement Investigations Center (NEIC) Policies and Procedures, EPA-330/9-78-001-R, May 1978, Rev. December 1981. NTIS: 1-800-553-6847.

- — U.S. EPA, Guidance for the Preparation of Standard Operating Procedures for Quality-Related Operations, EPA/600/R-96/027, November 1995 (EPA QA/G-6).
- — U.S. EPA, Guidance for the Data Quality Assessment Process: Practical Methods for Data Analysis, EPA/600/R-96/084, January 1998 (EPA QA/G-9).
- — U.S. EPA, Guidance for the Data Quality Objectives Process, EPA/600/R-96/055, September 1994 (EPA QA/G-4).
- — U.S. EPA, EPA Guidance for Quality Assurance Project Plans, EPA/600/R-98/018, February 1998 (EPA QA/G-5).
- — U.S. EPA, EPA Requirements for Quality Assurance Project Plans, November 1999 (EPA QA/R-5).
- — U.S. EPA, Region 9, Draft Laboratory Documentation Requirements for Data Validation, July 1997 (9QA-07-97).

C Appendices and/or attachments
Applicable appendices and/or attachments include but are not limited to the following:
- — List of standard operating procedures (SOPs) for sampling, drilling, sample preparation and analysis, etc., that are included as attachments.
- — If the optional QAPP worksheets are used, list of completed QAPP worksheets that are included as attachments, if not included as tables in the QAPP.
- — List of Laboratory Quality Assurance Plans (LQAPs) or Quality Assurance Manuals (LQAMs) for participating laboratories, which are included as attachments.

C List of tables
C List of figures
C List of diagrams

A.2.2 Document Control Format

Document control procedures are used to identify the most current version of the QAPP and to help ensure that only the most current version of the QAPP is used by all project participants.

Document Control Format – Use the following document control format (with the exceptions noted below) starting with the Title and Approval Page and including the Table of Contents, and all figures, tables, and diagrams. Include, in the upper right-hand corner of each page:

C The title of the document (abbreviations may be used).
C The original version number or revision number, whichever is applicable, and document status (i.e., draft, interim draft, interim final, final).
C The date of the original version (i.e., draft, interim draft, interim final, final) or current revision, whichever is applicable.
C The page number in relation to the total number of pages. Alternatively, pages may be numbered as part of the total pages for a discrete section. (In the case of the second option,

the Table of Contents should list inclusive page numbers for each subsection, i.e., 1-1 through 1-9, etc.).

Differentiate each revision of the QAPP with a new revision number and date.

A.2.3 Document Control Numbering System

A document control numbering system accounts for all copies of the QAPP provided to project personnel and helps to ensure that the most current version is in use. A sequential numbering system is used to identify controlled copies of the QAPP. Controlled copies should be assigned to individuals within an organization or team. Individuals receiving a controlled copy of the QAPP are provided with all revisions, addenda, and amendments to the QAPP. Those individuals in receipt of a controlled copy are responsible for removing all outdated material from circulation.

The document control system does not preclude making and using copies of the QAPP; however, the holders of the controlled copies are responsible for distributing revised or added material to update any copies within their organizations. The distribution list for controlled copies should be maintained by the organization that prepares the QAPP, and a copy of that distribution list should be provided to the Lead Organization.

A.2.4 QAPP Identifying Information

The information presented on the example QAPP Identifying Information Worksheet (Figure 2) prefaces the information in the QAPP and places the document in context for the reviewer. It identifies the key project players, whether previous site work has been performed, and the program for which the current project is being performed. Note that the optional worksheet does not have to be used; however, this information must be presented in the QAPP.

Figure 2. Example: QAPP Identifying Information Worksheet

Figure 2. Example: QAPP Identifying Information (Worksheet #2)

Site Name/Project Name: *North Street Property*
Site Location: *Wordsworth, NH*
Site Number/Code: *0195X*
Operable Unit: *01*
Contractor Name: *Chaucer Engineering*
Contractor Number: *690*
Contract Title: *BESTs*
Work Assignment Number: *97-1-12-34*

Title: *North Street Property QAPP*
Revision Number: *1*
Revision Date: *1/9/98*
Page *17* **of** *167*

1. Identify guidance used to prepare QAPP:
   Federal Consensus for the Preparation of QAPPs, Section 2, Draft August 2000
   and/or other:

2. Identify program: *RCRA-Corrective Action*

3. Identify approval entity: *EPA-NE*

4. Indicate whether the QAPP is a generic program QAPP or a project-specific QAPP. (circle one)

5. List dates scoping meetings were held: 10/25/97, 11/7/97, 11/26/97

6. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Approval Date
North Street Property - Emergency Response	01/06/96

7. List organizational partners (stakeholders) and connection with Lead Organization:
   Wordsworth, New Hampshire Board of Health,
   Police, Fire, and Sanitation Departments, and
   NH Department of Environmental Services

8. List data users: *EPA-NE RCRA Facility Manager, Poe Recycling (Lead Organization),*
   EPA-NE Risk Assessors

9. If any required QAPP elements (1- 20), worksheets, and/or required information are not applicable to the project, then circle the omitted QAPP elements, worksheets, and required information on the attached Table 1. Provide an explanation for their exclusion below:
   Section A.4.4 not applicable - specialty training not necessary to collect monitoring well samples.

QAPP Identifying Information (continued)

Circle QAPP elements and required information that are not applicable to the project. Provide an explanation in this section of the QAPP.

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S)	REQUIRED INFORMATION
Project Management and Objectives	
A.1 Title and Approval Page	- Title and Approval Page
A.2 Table of Contents and Document Format A.2.1 Table of Contents A.2.2 Document Control Format A.2.3 Document Control Numbering System A.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information
A.3 Distribution List and Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet
A.4 Project Organization A.4.1 Project Organizational Chart A.4.2 Communication Pathways A.4.2.1 Modifications to Approved QAPP A.4.3 Personnel Responsibilities and Qualifications A.4.4 Special Training Requirements/Certification	- Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table
A.5 Project Planning/Problem Definition A.5.1 Project Planning Meetings A.5.2 Problem Definition/Site History and Background	- Project Planning Meeting Documentation - Project Scoping Meeting Attendance Sheet with Agenda - Problem Definition/Site History and Background - Site Maps (historical and present)
A.6 Project Description and Schedule A.6.1 Project Overview A.6.2 Project Schedule	- Project Description - Contaminants of Concern and Other Target Analytes Table - Field Quality Control Sample Summary Table - Analytical Services Table - System Designs - Project Schedule Timeline Table
A.7 Project Quality Objectives and Measurement Performance Criteria A.7.1 Project Quality Objectives A.7.2 Measurement Performance Criteria	- Measurement Performance Criteria Table

QAPP Identifying Information (continued)

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S)	REQUIRED INFORMATION
Measurement/Data Acquisition	
B.1.1 Sampling Process Design B.1.1.1 Sampling Design Rationale	- Sampling Design and Rationale - Sampling Locations, Sampling and Analysis Methods/SOP Requirements Table - Sample Location Map
B.1.2 Sampling Procedures and Requirements B.1.2.1 Sampling Procedures B.1.2.2 Sampling SOP Modifications B.1.2.3 Cleaning and Decontamination of Equipment/Sample Containers B.1.2.4 Field Equipment Calibration B.1.2.5 Field Equipment Maintenance, Testing, and Inspection Requirements B.1.2.6 Inspection and Acceptance Requirements for Supplies/Sample Containers	- Sampling SOPs - Project Sampling SOP Reference Table - Sampling Container, Volumes, and Preservation Table - Field Sampling Equipment Calibration Table - Cleaning and Decontamination SOPs - Field Equipment Maintenance, Testing, and Inspection Table
B.1.3 Sample Handling, Tracking, and Custody Requirements B.1.3.1 Sample Collection Documentation B.1.3.1.1 Field Notes B.1.3.1.2 Field Documentation Management System B.1.3.2 Sample Handling and Tracking System B.1.3.3 Sample Custody	- Sample Handling, Tracking and Custody SOPs - Sample Handling Flow Diagram - Sample Container Label (Sample Tag) - Chain-of-Custody Form and Seal
B.2.1 Field Analytical Method Requirements B.2.1.1 Field Analytical Methods and SOPs B.2.1.2 Field Analytical Method/SOP Modifications B.2.1.3 Field Analytical Instrument Calibration B.2.1.4 Field Analytical Instrument/ Equipment Maintenance, Testing, and Inspection Requirements B.2.1.5 Field Analytical Inspection and Acceptance Requirements for Supplies	- Field Analytical Methods/SOPs - Field Analytical Method/SOP Reference Table - Field Analytical Instrument Calibration Table - Field Analytical Instrument/Equipment Maintenance, Testing, and Inspection Table

QAPP Identifying Information (continued)

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S)	REQUIRED INFORMATION
B.2.2 Fixed Laboratory Analytical Method Requirements B.2.2.1 Fixed Laboratory Analytical Methods and SOPs B.2.2.2 Fixed Laboratory Analytical Method/SOP Modifications B.2.2.3 Fixed Laboratory Instrument Calibration B.2.2.4 Fixed Laboratory Instrument/ Equipment Maintenance, Testing, and Inspection Requirements B.2.2.5 Fixed Laboratory Inspection and Acceptance Requirements for Supplies	- Fixed Laboratory Analytical Methods/SOPs - Fixed Laboratory Analytical Method/SOP Reference Table - Fixed Laboratory Instrument Maintenance and Calibration Table
B.3.1 Quality Control Requirements B.3.1.1 Sampling Quality Control B.3.1.2 Analytical Quality Control B.3.1.2.1 Field Analytical QC B.3.1.2.2 Fixed Laboratory QC	**Sampling** - Field Sampling QC Table - Field Sampling SOP Precision and Accuracy Table **Analytical** - Field Analytical QC Sample Table - Field Analytical Method/SOP Precision and Accuracy Table - Field Screening/Confirmatory Analysis Decision Tree - Fixed Laboratory Analytical QC Sample Table - Fixed Laboratory Method/SOP Precision and Accuracy Table
B.4.1 Data Acquisition Requirements	- Non-Direct Measurements Criteria and Limitations Table
B.5.1 Documentation, Records, and Data Management B.5.1.1 Project Documentation and Records B.5.1.2 Field Analysis Data Package Deliverables B.5.1.3 Fixed Laboratory Data Package Deliverables B.5.1.4 Data Reporting Formats B.5.1.5 Data Handling and Management B.5.1.6 Data Tracking and Control	- Project Documents and Records Table - Data Management SOPs

QAPP Identifying Information (continued)

REQUIRED QAPP ELEMENT(S) AND CORRESPONDING QAPP SECTION(S)	REQUIRED INFORMATION
Assessment/Oversight	
C.1 Assessments and Response Actions C.1.1 Planned Assessments C.1.2 Assessment Findings and Corrective Action Responses C.1.3 Additional QAPP Nonconformances	- Assessment and Response Actions - Project Assessment Table - Audit Checklists
C.2 QA Management Reports	- QA Management Reports Table
Data Verification/Validation and Usability	
D.1 Verification and Validation Requirements and Procedures	- Data Verification/Validation Process Table - Data Verification/Validation Summary Table
D.2 Data Usability/Reconciliation with Data Quality Objectives	- Data Usability Assessment

Note: All OPTIONAL QAPP Worksheets, when used, should be completed with project-specific information. If the OPTIONAL QAPP Worksheets are not used, the information the worksheets require must still be presented in the QAPP. In addition, other project-specific information should be provided in tabular format, as much as practicable. However, sufficient written discussion in text format should accompany these tables. Certain sections, by their nature, will require more written discussion than others. In particular, Section B.1.1 should provide an in-depth explanation of the sampling design rationale and Sections D.1 and D.2 should describe the procedures and criteria that will be used to verify, validate, and assess data usability.

A.3 Distribution List and Project Personnel Sign-Off Sheet

Distribution List

The Distribution List documents those entities to whom copies of the approved QAPP and any subsequent revisions will be sent. A complete copy of the QAPP should be sent to the Project Manager and key project personnel for the Lead Organization and EPA (or delegated approval authority). In addition, a complete copy of the original version and all revisions of the QAPP, including addenda and amendments, should be maintained on file by the Lead Organization and available to EPA upon request. Key project personnel include Project Team members as described in Section A.5.1 of this Manual.

Distribution List – Provide a Distribution List for the original version and each revision of the QAPP that contains the information shown in the Figure 3 example OPTIONAL QAPP Worksheet #3. This information is required whether or not the actual worksheet is used.

Figure 3. Example: Distribution List

Figure 3. Example: Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Document Control Number
Howard Fast	*Poe Recycling Project Manager*	*Poe Recycling*	*603-667-1100*	*FAZ11509*
Danny Steele	*Poe Recycling QA Officer*	*Poe Recycling*	*603-667-1112*	*FAZ11510*
Dorothy Parker	*Project Manager/Geotechnical Engineer*	*Chaucer Engineering*	*781-957-0171*	*FAZ11511*
Claire Carpenter	*Project QA Officer*	*Chaucer Engineering*	*781-957-0173*	*FAZ11512*
Frank Pemberton	*Project Health & Safety Officer*	*Chaucer Engineering*	*781-957-0172*	*FAZ11513*
James Keller	*Field Sampling Coordinator*	*Chaucer Engineering*	*781-957-0170*	*FAZ11514*
Charles Dickens	*Well Installer*	*Copperfield Drilling*	*781-888-0900*	*FAZ11515*
Robert Galvani	*Laboratory Manager*	*Austin Laboratories*	*401-273-5542*	*FAZ11516*
John Grissom	*Laboratory QA/QC Manager*	*Austin Laboratories*	*401-273-5542*	*FAZ11517*
Brendan Rivers	*Data Validator*	*BDO Quality Services*	*508-667-1100*	*FAZ11518*
Henry Thoreau	*EPA Project Manager*	*US EPA-NE*	*781-555-9900*	*FAZ11519*
John Donne	*EPA QA Chemist*	*US EPA-NE*	*781-555-9900*	*FAZ11520*
Hercule Poirot	*EPA Risk Assessor*	*US EPA-NE*	*781-555-9900*	*FAZ11521*
Scott Fitzgerald	*Risk Assessor*	*Eco-Risk*	*321-568-4488*	*FAZ11522*

Project Personnel Sign-Off Sheet

The Project Personnel Sign-Off Sheet documents that all key project personnel performing work have read the applicable sections of the QAPP and will perform the tasks as described. Project personnel include those persons working for the Lead Organization, including contractors and subcontractors. For example, the laboratory manager who receives the QAPP should have all supervisory personnel sign off on the applicable analysis sections of the QAPP before beginning sample analysis. Other examples of key personnel include the lead field sampler, Project Manager, and Laboratory QC Manager. Those in supervisory or oversight positions must communicate the requirements of the applicable portions of the QAPP to those doing work. It is the responsibility of the Project Team to identify during planning the personnel, by function, who must sign off as having read the applicable sections of the QAPP.

Project Personnel Sign-Off Sheet – Provide an example of a Project Personnel Sign-Off Sheet for the original version and each revision of the approved QAPP that contains information, as shown in the Figure 4 example OPTIONAL QAPP Worksheet #4. Although it is not always possible to identify people by name during the early planning stages, the project team still must identify signatories by function, such as the Laboratory QC Manager.

Figure 4. Example: Project Personnel Sign-Off Sheet

Figure 4. Example: Project Personnel Sign-Off Sheet

Organization: *Austin Laboratories*

Title	Telephone Number	Signature	Date QAPP Read	QAPP Acceptable as Written
Laboratory Manager	*401-273-5542*	*Robert Galvani*	*2/1/98*	*yes*
Laboratory QA/QC Manager	*401-273-5542*	*John Grissom*	*2/1/98*	*yes*
GC/MS Operator	*401-273-5542*	*Lucy Alcott*	*2/1/98*	*yes*
Sample Custodian/Data Manager	*401-273-5542*	*Walter Emerson*	*2/1/98*	*yes*

A.4 Project Organization

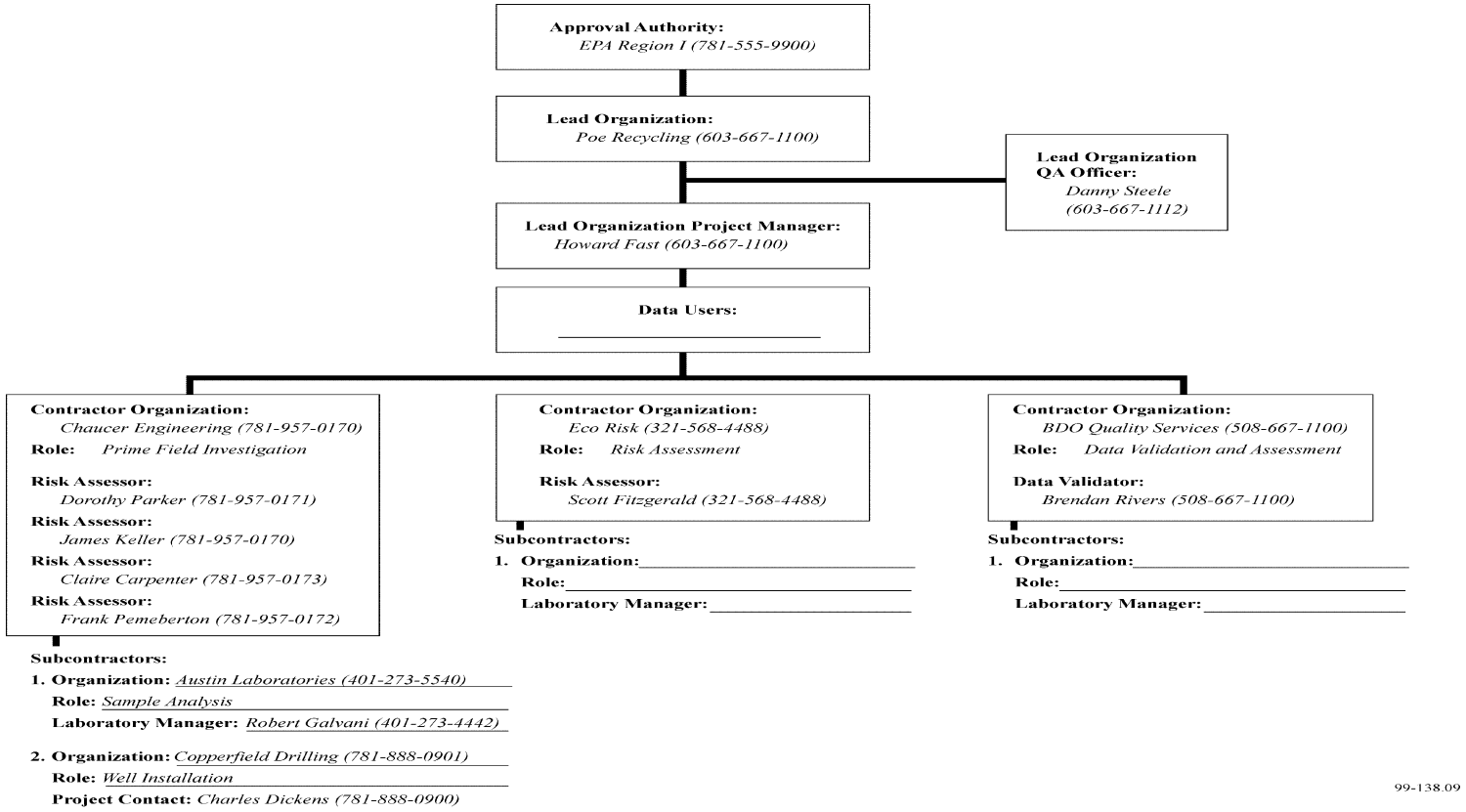
The "Project Organization" section identifies the organizations, Project Team members, and other key personnel participating in the project and describes their specific roles, responsibilities, and qualifications. This section of the QAPP also provides an explanation of the lines of authority, reporting relationships, and communication paths.

A.4.1 Project Organizational Chart

Organizational Chart – Provide an Organizational Chart that identifies all organizations involved in the project, including the Lead Organization and all contractor and subcontractor organizations and their telephone numbers. Include the names of all Project Managers, Project Team members, and/or Project Contacts for each organization and their telephone numbers. Refer to Section A.5.1 of this Manual for a discussion of the Project Team. An example of a completed Organizational Chart is provided in Figure 5.

Figure 5. Example: Organizational Chart

Figure 5. Example: Organizational Chart



A.4.2 Communication Pathways

One of the keys to a successful project is communication. To that end, communication pathways and modes of communication (faxes, newsletters, electronic mail, reports, etc.) should be delineated in the project planning stage and documented in the QAPP. These pathways include the points of contact for resolving field and laboratory problems and the points of contact for the flow of preliminary, screening, and final data to managers, users, and the public. Describe the proper procedures for soliciting concurrence and/or obtaining approval between project personnel, between different contractors, and/or between samplers and laboratory staff.

For example, complete the following statements:

- If field sampling will be delayed, then the Project Manager from the field sampling contractor organization will notify_____.
- No data may be released to the public until _____.
- If the laboratory fails to accurately analyze a Performance Evaluation Sample (PES), then the Project Manager from the Lead Organization will_____ _____.

A.4.2.1 Modifications to Approved QAPP

This section documents the procedures that will be followed when any project activity originally documented in an approved QAPP requires real-time modification to achieve project goals. These project activities include, but are not limited to:

- Sampling design
- Sample collection procedures
- Sample analysis procedures
- Data assessment and reporting

All QAPP modifications must be documented and submitted for approval in the same manner as the original QAPP. The person requesting a modification, the person approving the modification, and the rationale for the modification must be documented in writing.

Describe the procedures for initiating modifications to project activities and provide this information in the QAPP. State who has the authority to initiate procedural modifications. Describe how amendments to the QAPP will be documented and submitted to EPA, or the delegated authority, for approval. All amendments to the QAPP must be incorporated into the final version of the QAPP that is maintained by the Lead Organization as a part of the official site records.

The QAPP should spell out the difference between a modification to the QAPP and a one-time deviation from the QAPP. All deviations and the reasons for the deviation must be documented in writing and incorporated into the project files. In the case of a time-sensitive issue, verbal approval for the change may be given. However, any such change must be documented in writing and included in the project files. The QAPP must specify who has the authority for requesting and for issuing verbal approvals for QAPP modifications or one-time deviations from the approved QAPP.

A.4.3 Personnel Responsibilities and Qualifications

Personnel Responsibilities and Qualifications Table with Attached Resumes – Identify the project personnel participating in responsible roles by title and affiliation. The Lead Organization must certify that the key personnel meet any specific QAPP qualifications, such as laboratory certification, or that a person is a Professional Engineer (P.E.).

This table must include:

- Data users – The persons who will make decisions based on the collected data.
- Lead Organization Project Manager – Person with the responsibility and authority to allocate resources and personnel to accomplish the project tasks as documented in the QAPP.
- Lead Organization Quality Assurance Officer – Individual who provides QA oversight of project activities and who works independently of those performing project tasks.
- Project Manager(s) and/or Project Contact(s) for other organizations involved in the project (Include both prime contractors and subcontractors).
- QA Manager/Officer and/or QA Contact for other organizations involved in the project. **(Quality Assurance Manager or Project QA Officer must be independent of the group performing the task. In other words, the person responsible for checking that correct procedures are used should not be performing the tasks.)** Include both prime contractors and subcontractors.
- Project Health and Safety Officer – Include both prime contractors and subcontractors.
- Geotechnical engineers and hydrogeologists – Include both prime contractors and subcontractors.
- Field operation personnel, including field sampling coordinator, drillers, direct-push technology operators (Geoprobes, Cone Penetrometers), and field sampling personnel – Include both prime contractors and subcontractors.
- Analytical services, including on-site field analytical support and off-site fixed laboratory services – Include both prime contractors and subcontractors.
- Data validators – Include both prime contractors and subcontractors.
- Data usability assessors – Include both prime contractors and subcontractors.
- Risk assessors – Include both prime contractors and subcontractors.

An example of the completed OPTIONAL QAPP Worksheet #6, Personnel Responsibilities and Qualifications Table, is provided in Figure 6.

Figure 6. Example: Personnel Responsibilities and Qualifications Table

Figure 6. Example: Personnel Responsibilities and Qualifications Table

Name	Title	Affiliation	Responsibilities	Education and Experience Qualifications
*Howard Fast**	*Poe Recycling Project Manager*	*Poe Recycling*	*Coordinates and oversees project management for Lead Organization. Oversees contractor work.*	*M.S. Engineering, P.E., 25 yrs exp.*
*Danny Steele**	*Poe Recycling QA Officer*	*Poe Recycling*	*Oversees project QA/QC activities performed for Lead Organization.*	*Ph.D. Chemistry, 20 yrs exp.*
*Dorothy Parker**	*Project Manager*	*Chaucer Eng.*	*Directs contracted project work and provides geotechnical expertise.*	*B.S. Engineering, P.E., 15 yrs exp.*
*Claire Carpenter**	*Project QA Officer*	*Chaucer Eng.*	*Oversees project QA/QC activities performed by Chaucer Eng. and its subcontractors.*	*M.S. Chemistry, 20 yrs exp.*
*Frank Pemberton**	*Project H&S Officer*	*Chaucer Eng.*	*Directs health & safety program implemented for project.*	*B.S. Chemistry, CIH, 20 yrs exp.*
*James Keller**	*Field Sampling Coordinator*	*Chaucer Eng.*	*Directs field sampling activities.*	*B.S. Biology, 10 yrs exp.*
Charles Dickens	*Well Installer*	*Copperfield Drilling*	*Subcontractor for Chaucer Eng. Installs monitoring wells.*	*H.S. Diploma, 10 yrs exp.*
*Robert Galvani**	*Laboratory Manager*	*Austin Laboratories*	*Subcontractor for Chaucer Eng. Manages analytical data quality.*	*M.S. Chemistry, 10 yrs exp.*
John Grissom	*Laboratory QA/QC Manager*	*Austin Laboratories*	*Oversees analytical QA/QC activities and identifies necessary Corrective Actions.*	*M.S. Chemistry, 10 yrs exp.*
Lucy Alcott	*GC/MS Operator*	*Austin Laboratories*	*Operates GC/MS instrument.*	*M.S. Chemistry, 5 yrs GC/MS exp*
Walter Emerson	*Sample Custodian/Data Manager*	*Austin Laboratories*	*Logs samples into laboratory, archives field samples and extracts. Generates data packages.*	*B.S. Biology, 5 yrs exp.*
*Brendan Rivers**	*Data Validator*	*BDO Quality Services*	*Verifies and validates organic data.*	*B.S. Biology, 4 yrs exp.*
*Scott Fitzgerald**	*Risk Assessor*	*Eco-Risk*	*Performs risk assessment for Lead Organization.*	*M.S. Biology, 10 yrs exp.*

A.4.4 Special Training Requirements/Certification

All project personnel must be qualified and experienced in the project tasks for which they are responsible. Certain projects require uniquely trained personnel to perform specialized field reconnaissance, sampling, field or off-site analysis, data validation, and other project functions. If specialized training is not applicable to a particular project, then this section is not applicable to the project.

Provide an explanation of the special training that is needed to achieve project objectives.

Special Personnel Training Requirements Table – Provide a Special Personnel Training Requirements Table, for those projects requiring specialized training, that contains the information shown in the Figure 7 example of OPTIONAL QAPP Worksheet #7. Include training records and/or certificates as attachments to the worksheet. If training records and/or certificates are on file elsewhere, then document their location. If training records and/or certificates do not exist or are unavailable, note this information in the QAPP.

Figure 7. Example: Special Personnel Training Requirements Table

Figure 7. Example: Special Personnel Training Requirements Table

Project Function	Specialized Training – Title of Course or Description	Training Provided By	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates*
Trace Metal Sampling of Ambient Water	*Clean Hands/Dirty Hands Sampling Technique for Trace Metals – OW Method 1669*	*Tom Cabin of EPA Region II*	*09/22/97*	*Harriet Stowe*	*Sampling Crew Leader*	*Training record included as attachment to the QAPP*
Low Flow Sampling	*Low Flow Sampling Region I SOP*	*Heathcliff Jones of EPA Region I Office of Environmental Measurement and Evaluation*	*06/30/97*	*Jane Bronte*	*Sampler (Member of the Sampling Crew)*	*Training records filed in Prime Contractors training records at Corporate Headquarters – Available upon request (203-682-5282)*

*If training records and/or certificates are on file elsewhere, document their location in this column. If training records and/or certificates do not exist or are not available, then this should be noted.

A.5 Project Planning/Problem Definition

This section of the QAPP documents project planning, identifies the environmental problem, defines the environmental questions that need to be answered, and provides background information. To ensure QAPP approval, this section must provide a historical, regulatory, and programmatic context for the project and must convey to the reviewer a clear understanding of the project background and environmental problem that exists.

A.5.1 Project Planning Meetings (Scoping Meetings)

Project scoping meetings are key to the success of any project and should be held by the Project Team prior to QAPP preparation. This section of the QAPP documents the project planning meetings held during the initial planning phase. Scoping meetings are held to define the purpose and expected results of the project; the environmental decisions that need to be made; the project quality objectives necessary to achieve expected results and support environmental decisions; the sampling, analytical, and data assessment activities that will be performed; and the final products and deliverables for the project.

Identify the Project Team members who are responsible for planning the project. The actual size of the Project Team will be determined by the size and complexity of the project. Individuals responsible for the following tasks are critical to the success of the project and should be selected as Project Team members by the Lead Organization: project management, health and safety, field mobilization, sampling, geotechnical operations, sample analyses, and QA activities, including field and laboratory assessments, data validation, and data usability and risk assessments. The size of the Project Team should reflect the complexity of the project. For example, small projects may use Project Teams that consist of only two or three people. Participants should include project management, data generators (including field and laboratory personnel), data validators, quality assurance personnel, data users, and any other stakeholders.

If the OPTIONAL QAPP Worksheets are being used, then at the initial scoping meeting the Project Team should begin by completing them using as much information as is available. The worksheets should be finalized at subsequent meetings and included as tables, diagrams, and figures in the QAPP. The QAPP should include explanatory text for tables, figures, and diagrams whenever necessary. If the worksheets are not used, the Project Team members must produce a QAPP that contains the information required by this Manual.

Data quality objectives (DQOs) define the type, quantity, and quality of data needed to answer specific environmental questions and support proper environmental decisions. DQOs should be determined and agreed upon at the initial scoping sessions. Data users must decide and agree upon

when to collect samples, where to collect samples, how many samples to collect, and how accurate and precise data must be before it can be used to make decisions.

When critical environmental decisions must be made, the Project Team should follow the formal DQO process as described in the guidance document, *Guidance for the Planning for Data Collection in Support of Environmental Decision-Making Using the Data Quality Objective Process*, September 1994, EPA/600/R-96/055 (EPA QA/G-4). The formal DQO process as described in EPA QA/G-4 requires statistical expertise to define the amount of error acceptable when making an environmental decision and includes the following seven steps:

Request to Reviewers

What specific DoD and DOE documents are equivalent guidance documents?

Step 1: State the Problem
Step 2: Identify the Decision
Step 3: Identify the Inputs to the Decision
Step 4: Define the Study Boundaries
Step 5: Develop a Decision Rule
Step 6: Specify Tolerable Limits on Decision Error
Step 7: Optimize the Design

Statistical analysis is beyond the scope of many projects; therefore, the development of formal DQOs using the process described in EPA QA/G-4 will depend on the critical nature of the environmental decisions to be made as determined by the Project Team.

For data collection activities that are either exploratory or small in nature, or where specific decisions cannot be identified, the formal DQO process is not necessary. For these projects, the Case Team should use an abbreviated DQO approach (Steps 1-4, described above) to help identify the DQOs and Action Limits, and to select appropriate sampling, analytical, and assessment activities.

Site-specific DQOs identified at the scoping meetings should be documented in the QAPP.

Project Scoping Meeting Documentation – Document each scoping meeting. For each scoping meeting, provide a Project Scoping Meeting Attendance Sheet that contains information, such as that presented in the Figure 8 example, OPTIONAL QAPP Worksheet #8.

Include the agenda for project scoping meetings and meeting notes in the QAPP. Summarize the DQOs in the QAPP. An example of a QAPP Summary Form is included in Appendix 2.

Figure 8. Example: Project Scoping Meeting Attendance Sheet

Figure 8. Example: Project Scoping Meeting Attendance Sheet

EPA Regulation Program: RCRA FIFRA TSCA CERCLA DW CWA CAA **Program: Brownfields, NPDES, etc.** *Voluntary Cleanup* **Projected Date(s) of Sampling** *2/20/98* **Project Manager** *Howard Fast*	**Site Name** *North Street Property* **Site Location** *Wordsworth, NH* **CERCLA Site/Spill Identifier No. 01** **Operable Unit** *01* **Other Site Number/Code** *0195X* **Phase: ERA SA/SI pre-RI RI (phase I, etc.) FS RD RA post-RA (circle one)** **Other phase:**

Date of Meeting: *12/20/97*
Meeting Location: *Poe Recycling*

Name	Title	Affiliation	Phone #	Project Role
Howard Fast	*Poe Recycling Project Manager*	*Poe Recycling*	*603-667-1100*	*Project Manager of Lead Organization*
Danny Steele	*Poe Recycling QA Officer*	*Poe Recycling*	*603-667-1112*	*Oversees Project QA for Lead Organization*
Dorothy Parker	*Project Manager*	*Chaucer Eng.*	*781-957-0171*	*Contractor Project Manager*
Claire Carpenter	*Project QA Officer*	*Chaucer Eng.*	*781-957-0173*	*Oversees Project QA*
Frank Pemberton	*Project H&S Officer*	*Chaucer Eng.*	*781-957-0172*	*Oversees Project H&S*
James Keller	*Field Sampling Coordinator*	*Chaucer Eng.*	*781-957-0170*	*Coordinates Field Sampling*
Robert Galvani	*Laboratory Manager*	*Austin Labs*	*401-273-5542*	*Project Lab Manager*
Henry Thoreau	*EPA Project Manager*	*US EPA-NE*	*781-555-9900*	*EPA-NE Project Oversight*
John Donne	*EPA QA Chemist*	*US EPA-NE*	*781-555-9900*	*EPA-NE QA/QC*
Hercule Poirot	*EPA Risk Assessor*	*US EPA-NE*	*781-555-9900*	*EPA-NE Oversight Project Risk Assessment*
Brendan Rivers	*Data Validator*	*BDO*	*508-667-1100*	*Data Validation*
Scott Fitzgerald	*Risk Assessor*	*Eco-Risk*	*321-568-4488*	*Risk Assessment*

Meeting Purpose: *Site Conceptual Design*

Comments: Discussed sampling locations, contaminants of concern and project Action Limits

A.5.2 Problem Definition/Site History and Background

This section frames, for the reader/reviewer, the reasons for conducting the project. It presents historic information, current site condition descriptions, and other existing data applicable to the project. This information is used to clearly define the problem and the environmental questions that must be answered for the current investigation. This information will be used to develop the project decision "If..., then..." statements in the QAPP that link data results and possible actions.

Summarize the following information in the text for this section of the QAPP:

- **The problem to be addressed by the project.** For example, "Residential drinking water wells in Toadville have shown increasing levels of benzene over the past two years."

- **The environmental questions being asked.** For example, "What is the source of the benzene contamination in the residential drinking water wells of Toadville, NH?"

- **Observations from any site reconnaissance reports.** Include pertinent existing site conditions. Information such as evident soil staining and the presence of free product materials, odors, and other known hazards should be identified and their location on-site specified. Physical objects such as metallic debris, drums, dilapidated buildings, processing equipment, and known safety hazards also should be identified and their location on-site specified.

- **A synopsis of non-direct measurement data/information from all site reports.** References to existing reports (e.g., monitoring reports and/or remedial investigation/ remedial action reports) that describe site conditions and indicator chemicals for long-term remediation and/or monitoring projects should be cited. Refer to Section B.4.1 of this Manual for a complete discussion of the identification and use of data acquired from secondary sources.

- **The possible classes of contaminants and the affected media,** as determined by historical site usage, site neighbors, industrial processes, process by-products, waste disposal practices, and possible contaminant breakdown products. The past and current chemical use information discussed in this section will be the basis for deciding the contaminants of concern to be investigated during the project.

- **The rationale for inclusion of chemical and nonchemical analyses.**

- **Information concerning various environmental indicators.** These indicators describe the present condition of the environment (water, soil, sludge, sediment, air, biota, etc.) and provide a benchmark to monitor changes in the condition of the environment.

Additionally, provide the following items in this section of the QAPP:

Site Maps – Include the following maps and/or figures:

- A detailed site map that shows the site in its present state and locates its boundaries
- A map that places the site in geographical context
- Historical maps or plans of the site prior to the investigation
- Maps identifying past and future sampling locations (refer to Section B.1.1.1)
- Historical and current aerial photographs

An 8 ½" x 11" copy of all site maps and drawings should be included in the QAPP in addition to larger, foldout maps and drawings.

A.6 Project Description and Schedule

This section of the QAPP provides a general overview of the activities that will be performed and how and when they will be performed based on background information/data, preplanning site visits, and scoping meetings. Identify these activities in the QAPP in text or on OPTIONAL QAPP Worksheet #9a. Specific details for individual project activities will be discussed in later sections of the QAPP.

Figure 9a. Example: Project Description Sections

Figure 9a. Example: Project Description Sections

Sampling Tasks:

Analysis Tasks:

Quality Control Tasks:

Secondary Data:

Data Management Tasks:

Documentation and Records:

Data Packages:

Assessment/Audit Tasks:

Data Verification and Validation Tasks:

Data Usability Assessment Tasks:

A.6.1 Project Overview (Outcome of Project Scoping Activities)

Project planning results in the Project Team's reaching agreement on the purpose of the project, the environmental questions that are being asked, and the environmental decisions that must be made. The Project Team decides on the project quality objectives, that is the type, quantity, and quality of data needed to ensure that project data can be used for its intended purpose to answer specific environmental questions and support environmental decisions. The Project Team determines criteria for how "good" the measurement data must be and documents those measurement performance criteria (MPC) in the QAPP.

The Project Team agrees on what environmental indicators and/or contaminants of concern (COCs) must be measured. They also determine the other target analytes that will be measured. Generally these other target analytes can be measured using the same analytical methods that are used to determine the COCs. The other target analytes have the potential of becoming COCs after site characterization activities.

Contaminants of Concern and Other Target Analytes Table (Reference Limits and Evaluation Table) – Complete the Contaminants of Concern and Other Target Analytes Table. Provide separate tables for each medium/matrix, concentration level, and analytical parameter. An example of a completed Contaminants of Concern and Other Target Analytes Table is provided in Figure 9b.

Figure 9b. Example: Contaminants of Concern and Other Target Analytes Table

Medium/Matrix: *Ground Water*
Analytical Parameter: *VOA*
Concentration Level: *Low*

Figure 9b. Example: Contaminants of Concern and Other Target Analytes Table (Reference Limits and Evaluation Table)

Analyte	CAS Number	Project Action Limit (Units) (wet or dry weight)	Project Quantitation Limit (Units) (wet or dry weight)	Analytical Method		Achievable Laboratory Limits	
				MDLs[1]	Method QLs[1]	MDLs[2]	QLs[2]
*Benzene	71-43-2	5 Fg/L	1 Fg/L	0.03	Not provided in method	0.10	0.50
*Trichloroethene	79-01-6	5 Fg/L	1 Fg/L	0.02	Not provided in method	0.11	0.50
*Vinyl Chloride	75-01-4	2 Fg/L	1 Fg/L	0.04	Not provided in method	0.11	0.50
1,2-Dichloroethane	107-06-2	5 Fg/L	1 Fg/L	0.02	Not provided in method	0.11	0.50
Carbon Tetrachloride	56-23-5	5 Fg/L	1 Fg/L	0.08	Not provided in method	0.12	0.50
1,2-Dichloropropane	78-87-5	5 Fg/L	1 Fg/L	0.02	Not provided in method	0.11	0.50
1,1,2-Trichloroethane	79-00-5	5 Fg/L	1 Fg/L	0.03	Not provided in method	0.13	0.50
Bromoform	75-25-2	5 Fg/L	1 Fg/L	0.20	Not provided in method	0.11	0.50

[1]Analytical method MDLs and QLs documented in validated methods. QLs are usually 3-10 times higher than the MDLs.
[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Note: Achievable method detection limits (MDLs) and quantitation limits (QLs) (as shown on Figure 9b), also referred to as practical quantitation limits (PQLs), represent the MDLs and QLs that an individual laboratory can achieve when performing a specific analytical method. An individual laboratory may not always be able to achieve the MDLs and QLs that are published in a validated method. In other words, even though a published analytical method may meet project requirements, this does not ensure that a laboratory can perform the analytical method satisfactorily. Therefore, laboratory MDLs and QLs/PQLs must be documented in the laboratory's SOP for each analytical method that the laboratory will perform for the project.

Project-required quantitation limits and Action Limits must be established prior to the selection of sampling and analytical methods. To compensate for potential analytical inaccuracy at the quantitation limit, project-required QLs should be at least two to five times less than the Action Limits, if achievable.

The QLs from individual methods and laboratories are evaluated relative to project-required Action Limits to determine their suitability to meet project quality objectives. If the published method QL exceeds the Action Limit for a COC or other target analyte, then that analytical method is unacceptable for the analysis of that analyte. (However, if a laboratory has modified the published method to achieve QLs that are less than the Action Limits, and documented this modification in its laboratory SOP, then that laboratory SOP *might* constitute an acceptable method. Refer to Section A.7.2 for additional guidance on quantitation limits.)

If the laboratory and method cannot achieve the project goals for QL and Action Limits, one of the following options must be pursued:

Option 1 - Use a different laboratory.
Option 2 - Use an alternative analytical method or a modified method.
Option 3 - Accept a higher level of uncertainty for data falling between the MDL and QL.
Option 4 - Adjust the project Action Limits to achieve the desired level of laboratory performance.

A.6.1.1 Sampling Tasks

Briefly explain the rationale for sampling specific media/matrices, concentration levels, and analytical parameters of concern and the rationale for the sampling design selected (including the logic used to determine sample locations and the type, number, and frequency of field samples). Refer sample locations to historical and current site maps (Section A.5.2). Include any additional maps, if necessary, to delineate site boundaries geographically, both horizontally and vertically. Provide complete details of the sampling rationale, process design, and sampling tasks in Section B.1.1 of the QAPP.

Briefly describe the sampling methods that will be used. Describe any new or innovative sampling techniques that will be employed. Also, describe any specialized equipment and/or associated operators that will be required. Provide complete descriptions of the sampling methods and associated sampling quality control, and identify all sampling, sample handling, and custody SOPs in Sections B.1.2, B.1.3, and B.1.3.3 of the QAPP.

Field and Quality Control Sample Summary Table – Summarize by matrix the number of field QC samples that will be collected for each analytical parameter and concentration level. This information should agree with the QAPP Summary Form (Appendix 2). An example of a Field Quality Control Sample Summary Table is provided in Figure 9c.

Figure 9c. Example: Field Quality Control Sample Summary Table

Figure 9c. Example: Field Quality Control Sample Summary Table

Medium/ Matrix	Analytical Parameter	Concentration Level	Analytical Method/ SOP Reference	No. of Sampling Locations[1]	No. of Field Duplicate Pairs	Organic		Inorganic		No. of VOA Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks	No. of Cooler Temp. Blanks	No. of PE Samples	Total No. of Samples to Lab
						No. of MS	No. of MSD	No. of Duplicates	No. of Spikes						
GW	*VOA*	*Low*	*524.2/L-1*	*14*	*1*	*1*	*1*			*1*	*0*	*1*	*1*	*1*	*21*
GW	*SVOC*	*Low/Medium*	*8270/L-2*	*6*	*1*	*1*	*1*			*0*	*1*	*1*	*1*	*1*	*13*
GW	*Metals*	*Low/Medium*	*CLL/L-3*	*15*	*1*	*0*	*0*	*1*	*1*	*0*	*0*	*1*	*1*	*1*	*21*

[1]If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location/station.

A.6.1.2 System Designs

Provide a brief description of activities for projects that involve remediation and/or monitoring engineering designs (e.g., groundwater extraction systems or soil/water/air treatment systems). Provide complete descriptions of the treatment/monitoring systems and include all treatment train schematics and process diagrams in Section B.1.1 of the QAPP.

A.6.1.3 Analytical Tasks

Briefly describe the analytical tasks to be performed, including the sample media/matrices, analytical parameters, and concentration levels, and provide a general description of analytical methods. Clearly differentiate analytical tasks that will be performed in the field from those performed in a fixed laboratory. Also, differentiate the data produced for each analytical task into "definitive" versus "screening" use categories. Describe any new analytical techniques that will be employed and explain how the new technique will provide improved data over traditional/standard methods. Also, describe any specialized equipment and/or analysts that will be required. Provide complete detailed descriptions of the analytical tasks and associated analytical quality control, and identify all analytical SOPs and methods in Sections B.2.1, B.2.2, and B.3.1 of the QAPP.

Identify the analytical services that will be provided for the project.

Analytical Services – Complete an Analytical Services Table. Identify the organization(s)/ laboratories that will provide the analytical services (for all field screening, field analytical, and fixed laboratory analytical work, including all prime laboratories, subcontractor laboratories, and backup laboratories) by medium/matrix, analytical parameter, and concentration level. An example of a completed Analytical Services Table is provided in Figure 9d.

Figure 9d. Example: Analytical Services Table

Figure 9d. Example: Analytical Services Table

Medium/ Matrix	Analytical Parameter	Concentration Level	Analytical Method/SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address: Contact Person and Telephone Number)
Soil	*VOA*	*Medium*	*F-1*	*14 days*	*Northeast Mobile Laboratory* *237 Canal St.* *Lebanon, VT* *Art Clunnie, 802 631-8600*	*EnviroSpec Laboratory* *105 Lake St.* *Burlington, VT* *Beth Reach, 802 842-6832*
Soil	*SVOA*	*Medium*	*F-2*	*35 days*	*Northeast Mobile Laboratory* *237 Canal St.* *Lebanon, VT* *Art Clunnie, 802 631-8600*	*EnviroSpec Laboratory* *105 Lake St.* *Burlington, VT* *Beth Reach, 802 842-6832*
Soil	*PEST/PCBs*	*Medium*	*F-3*	*35 days*	*Northeast Mobile Laboratory* *237 Canal St.* *Lebanon, VT* *Art Clunnie, 802 631-8600*	*EnviroSpec Laboratory* *105 Lake St.* *Burlington, VT* *Beth Reach, 802 842-6832*
Soil	*Metals*	*Medium*	*L-1*	*35 days*	*DoRite Laboratory* *83 Final St.* *Ace, NH* *Nancy Baker, 603 421-8215*	*CanDo Laboratory* *812 First St.* *Jack, NH* *Rich Worth, 603 629-8438*

A.6.1.4 Data Verification and Validation Tasks

Briefly discuss how data will be verified internally and validated externally and how analytical error will be assessed. If data will not be validated, then document this fact and provide justification in this section. Provide a complete description of the data verification and validation tasks and procedures in Section D.1 of the QAPP.

A.6.1.5 Quality Assurance Assessments

Include a short description of the quality assurance assessments that will be performed during the course of the project and the frequency at which each will be performed. If assessments are not planned, then document this fact and provide justification in this section. Provide a complete description of the planned assessments in Section C.1 of the QAPP.

A.6.1.6 Data Usability Assessments

Include a short description of how validated project data will be reconciled with the project quality objectives. Provide a complete description of data usability assessments in Section D.2 of the QAPP.

A.6.1.7 Records and Reports

Summarize the project documents, records, and reports that will be compiled and/or generated as part of the project and those that will be maintained in the site files. Itemize and describe all project documents, records, and reports that will be compiled and/or generated during the course of this project in Sections B.4.1, B.5.1, and C.2 of the QAPP.

A.6.2 Project Schedule

Project Schedule Timeline – Provide a schedule of the work to be performed in a graphical or tabular format. The timeline must include the start and completion dates for all project activities. Include the quality assurance assessments that will be performed during the course of the project. Schedule sufficient time for document review and implementation of effective corrective actions. An example of a completed Project Schedule Timeline Table is provided in Figure 10.

Figure 10. Example: Project Schedule Timeline Table

Figure 10. Example: Project Schedule Timeline Table

Activities	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
	Anticipated Date(s) of Initiation	Anticipated Date of Completion		
QAPP Preparation	*12/5/97*	*1/5/98*	*QAPP Document*	*1/9/98*
QAPP Approval by Region	*1/6/98*	*2/6/98*		
Well Installation	*2/15/98 - 2/25/98*	*2/25/98*	*Not Applicable*	*Not Applicable*
Sample Collection	*3/2/98 - 4/2/98*	*4/2/98*	*Not Applicable*	*Not Applicable*
Fixed Laboratory Technical Systems Audit	*2/1/98*	*2/1/98*	*TSA Report*	*2/15/98*
Field Sampling Technical Systems Audit	*3/2/98 - 3/10/98*	*3/10/98*	*TSA Report*	*3/15/98*
Laboratory Analysis	*3/23/98 - 4/23/98*	*4/23/98*	*Data Packages*	*4/23/98*
Data Validation	*4/6/98 - 5/7/98*	*5/7/98*	*Data Validation Reports*	*5/7/98*
Risk Assessment	*5/8/98*	*6/7/98*	*Risk Assessment Report*	6/7/98
Data Assessment Report	*5/8/98*	*6/7/98*	*Data Assessment Report*	*6/7/98*
Final Project Report Preparation	*6/8/98*	*7/6/98*	*Final Project Report*	*7/6/98*

Describe the procedure for notifying project participants concerning project schedule delays. Identify, by job function and organization name, the personnel responsible for providing as well as receiving such notification, and the personnel responsible for approving schedule delays.

Discuss all resource and time constraints, and identify all regulatory requirements and/or restrictions, that will affect the project schedule. Discuss all seasonal sampling restrictions and considerations.

A.7 Project Quality Objectives and Measurement Performance Criteria

This section of the QAPP documents the environmental decisions that need to be made and the level of data quality needed to ensure that those decisions are based on sound scientific data. Project quality objectives must be determined by the Project Team utilizing the Systematic Planning Process as outlined in Diagram 1 (in the Introduction) and Section A.7.1 below.

A.7.1 Project Quality Objectives

Systematic planning is a planning process that is based on the scientific method and includes concepts such as objectivity of approach and acceptability of results. Systematic planning is based on a commonsense, graded approach to ensure that the level of detail in planning is commensurate with the importance and intended use of the work, and the available resources. This framework promotes communication between all organizations and individuals involved in an environmental program. Through a systematic planning process, a team can develop acceptance or performance criteria or project quality objectives (PQOs) for the right type, quality, and quantity of the data collected and for the quality of the decision. PQOs ensure that the proper data are collected and generated to answer questions regarding a specific environmental problem.

The systematic planning process also ensures that appropriate project decisions are made. The planning process may incorporate the formal DQO process, as described in EPA QA/G-4, when critical environmental decisions are required, such as selecting between two clear alternative conditions (e.g., decision-making or compliance with a standard). However, for most monitoring and investigative data collection projects, an abbreviated DQO process should suffice. A summary of the DQO process is found in Appendix 3.

A systematic planning process results in qualitative and quantitative statements that answer the following questions:

- Who will use the data?
- What will the data be used for?

  Specify the anticipated uses of the data. Simple, clear statements should be used to describe the data uses, as in the following statements: “These data will be used to determine the nature and extent of contamination.” “These data will be used to determine the health risks to children ages 1-6 who reside on the site and who might be exposed to surface soils in the area.” “These data will be used to determine regulatory compliance with CERCLA statutes.” “These data will be used to assess the quality of the data generated by Potentially Responsible Parties (PRPs).” “These data will be used to identify the source of high nutrient loadings in the Meandering River.”

- What type of data are needed?
  Identify contaminants of concern and other target analytes and select analytical parameters; determine appropriateness of field screening, field analytical, and/or fixed laboratory techniques; evaluate appropriateness of different types of sampling techniques (e.g., low flow sampling).
- How "good" do the data need to be in order to support the environmental decision?
  Establish criteria for performance measures, including precision, accuracy/bias, sensitivity (quantitation limits), data comparability, representativeness, and completeness.
- How much data are needed?
  Determine the number of samples needed for each analytical parameter/matrix/and concentration level.
- Where, when, and how should the data be collected/generated?
- Who will collect and generate the data?
- How will the data be reported?

A.7.2 Measurement Performance Criteria

Once the environmental decisions have been identified, data users and QA personnel can determine the project quality objectives, including the measurement performance criteria, that must be satisfied in order to support defensible decisions.

Document the performance criteria selected for the project-specific sampling measurement systems that will ensure that project objectives are met. For example, appropriate performance criteria should be identified to ensure that monitoring wells will be installed correctly and will yield representative samples.

Document the performance criteria selected for the analytical measurement systems that will ensure that project objectives are met. The following paragraphs provide examples of developing performance criteria for the project-specific analytical measurement systems.

Measurement performance criteria should be determined for each matrix, analytical parameter, concentration level, and analyte, if applicable. These criteria are for precision, accuracy/bias, representativeness, comparability, sensitivity, quantitation limits, and completeness. These parameters indicate the qualitative and quantitative degree of quality associated with measurement data and, hence, are also referred to as data quality indicators (DQIs). DQIs are also referred to as the PARCC parameters. (DQIs should not be confused with the overall project quality objectives that are developed using the formal DQO process.)

A discussion of DQIs for which performance criteria should be developed follows.

Precision: Determine quantitative measurement performance criteria for acceptable field and laboratory precision for each matrix, analytical parameter, and concentration level. Also determine analyte-specific measurement performance criteria, if applicable. Determine what QA/QC activities and/or QC checks or samples will be performed or analyzed to measure precision for each matrix, analytical parameter, and concentration level.

Precision is the degree of agreement among repeated measurements of the same characteristic (analyte, parameter, etc.) under the same or similar conditions. Precision data indicate how consistent and reproducible the field sampling or analytical procedures have been. "Overall project precision" is measured by collecting data from replicate field samples. Precision specific to the laboratory is measured by analyzing laboratory replicate samples. Comparing overall project precision and laboratory precision will help to identify sources of imprecision if a problem exists.

If only two replicate samples are collected and analyzed, then these samples are referred to as field duplicates. If two aliquots of the same sample are prepared and analyzed by a laboratory, then these samples are referred to as laboratory duplicates. If two aliquots of the same prepared sample are analyzed in duplicate, then these samples are referred to as analytical duplicates. Duplicate precision is evaluated by calculating a Relative Percent Difference (RPD) using the following equation (the smaller the RPD, the greater the precision):

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100\%$$

where:

x_1 = original sample concentration
x_2 = replicate sample concentration

If more than two replicate samples are collected and analyzed, then these samples are referred to as field replicates. If two or more aliquots of the same sample are prepared and analyzed by a laboratory, then these samples are referred to as laboratory replicates. If more than two aliquots of the same prepared sample are analyzed in replicate, then these samples are referred to as analytical replicates. Replicate precision is evaluated by calculating the Relative Standard Deviation (RSD), also referred to as the coefficient of variation (V), of the samples using the following equation (the smaller the RSD, the greater the precision):

$$\%RSD = \frac{S}{mean} \times 100\%$$

where:

$$S = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$$

x_i = each individual value used for calculating the mean
x = the mean of n values
n = the total number of values

Accuracy/Bias: Determine quantitative measurement performance criteria for acceptable accuracy/ bias for each matrix, analytical parameter, and concentration level. Also determine analyte-specific measurement performance criteria, if applicable. Determine what QA/QC activities and/or QC checks or samples will be performed or analyzed to measure accuracy/bias for each matrix, analytical parameter, and concentration level.

Accuracy is the extent of agreement between an observed value (sample result) and the accepted, or true, value of the parameter being measured. Accuracy is frequently used synonymously with bias. Specifically, the term "bias" describes the systematic or persistent error associated with a measurement process. Both terms are used interchangeably in this document.

Analyte accuracy/bias can be evaluated using different types of QC samples. For example, a standard reference material (SRM) or a laboratory control sample (LCS), containing a known concentration of analyte(s) spiked into blank water or other blank matrices, provides information about how accurately the laboratory (analysts, equipment, reagents, etc.) can analyze for a specific analyte(s) using a selected method. Also, single-blind and double-blind performance evaluation (PE) samples provide information on how accurately the laboratory can analyze a specific analyte using a selected method. The cumulative laboratory and method accuracy/bias is calculated as a percentage using the following equation:

$$Accuracy/Bias = \frac{Measured\ Value}{True\ Value} \times 100\%$$

Because environmental samples contain interferences (i.e., other compounds that may interfere with the analysis of a specific analyte), the accuracy/bias for a specific analyte should be evaluated in relation to the sample matrix. This is done by analyzing matrix spike samples. A known concentration of the analyte is added to an aliquot of the sample. The difference between the concentration of the analyte in the unspiked sample and the concentration of the analyte in the spiked sample should be equal to the concentration of the analyte that was spiked into the sample. The spike recovery is calculated as a percentage using the following equation:

$$\%Recovery\ Accuracy/Bias = \frac{Spiked\ Sample\ Conc. - Unspiked\ Sample\ Conc.}{Spiked\ Conc.\ Added} \times 100\%$$

Frequently, matrix spike samples are prepared and analyzed in duplicate, especially for organic analyses, to provide sufficient precision and accuracy data to evaluate achievement of project quality objectives.

Note: In general, published methods provide precision and accuracy/bias statements that are supported by data generated during method validation studies. Additionally, laboratories should track and maintain records of precision and accuracy/bias trends for their QC samples (such as laboratory duplicates/replicates, SRMs, LCSs, and matrix spike analyses) and include acceptable precision and accuracy/bias ranges in their analytical SOPs. Published QC data, and familiarity with routine method performance, will allow project planners to choose project-required measurement performance criteria that are technically feasible.

Representativeness: Determine qualitative measurement performance criteria for acceptable representativeness for each matrix, analytical parameter, and concentration level. Also determine analyte-specific measurement performance criteria, if applicable. Determine what QA/QC activities and/or QC checks or samples will be performed or analyzed to measure representativeness for each matrix, analytical parameter, and concentration level.

Representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental conditions of a site. It takes into consideration the magnitude of the site area represented by one sample and assesses the feasibility/reasonableness of that design rationale. Representativeness also reflects the ability of the sample team to collect samples, and the ability of the laboratory personnel to analyze those samples, in such a manner that the data generated accurately and precisely reflect the conditions at the site. In other words, a discrete sample (that is collected and then subsampled by the laboratory) is representative when its measured contaminant concentration equates to the contaminant concentration of some predefined vertical and horizontal spatial area at the site. Consider the issues of sample homogeneity, and sampling and subsampling variability, when developing criteria for representativeness. The use of statistical sampling design

and standardized SOPs for sample collection and analysis helps to ensure that samples are representative of site conditions.

Comparability: Determine quantitative measurement performance criteria for acceptable data comparability for each matrix, analytical parameter, and concentration level. Also determine analyte-specific measurement performance criteria, if applicable. Determine what QA/QC activities and/or QC checks or samples will be performed or analyzed to measure data comparability for each matrix, analytical parameter, and concentration level.

Address such issues as consistency in sampling and analytical procedures within and between data sets. For example, monitoring well-sampling SOPs should require that well casings be notched or permanently marked so that the water level measurement is taken from the same spot for each sampling event. This will help to ensure data comparability for repeated water level measurements.

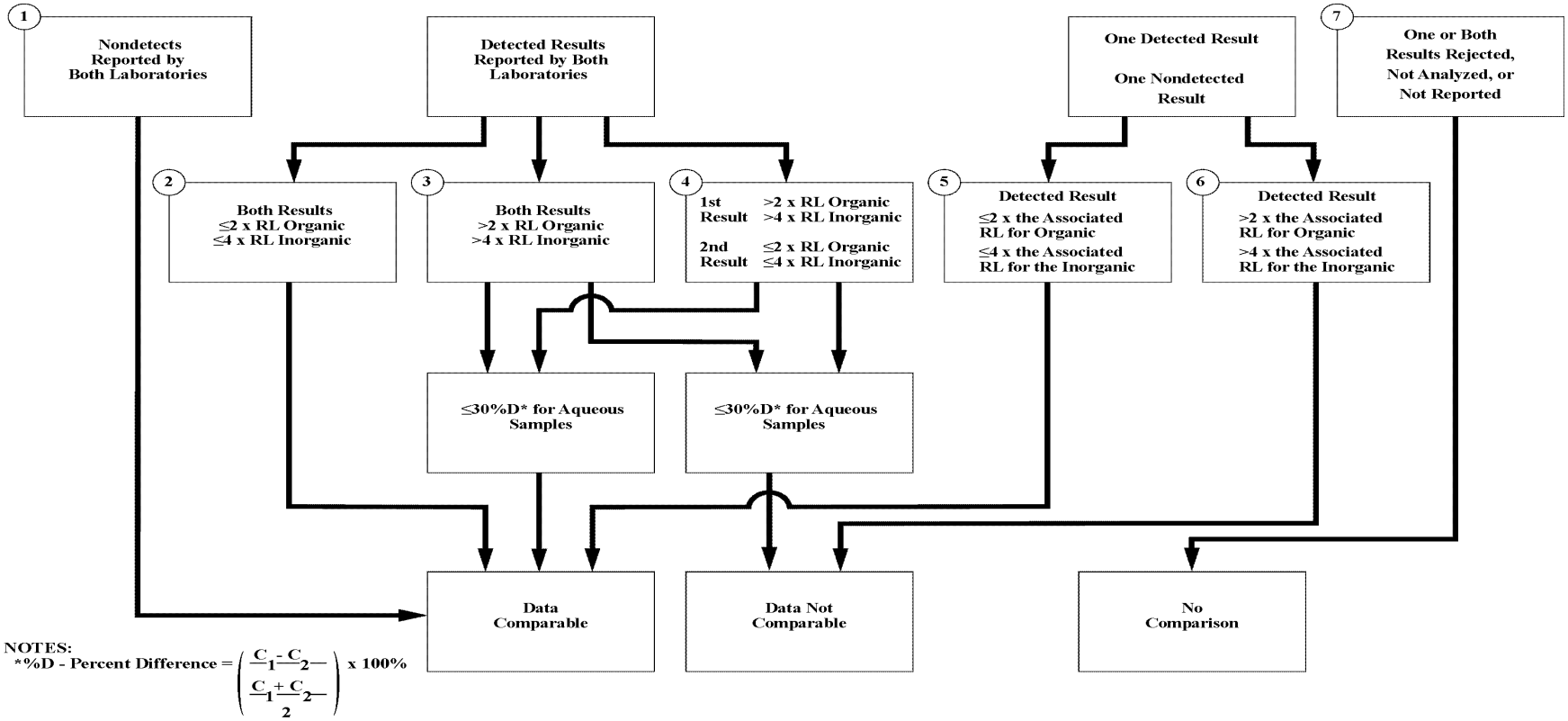
Oversight Split Sampling Data Comparability. Whenever oversight split sampling and analysis are performed (e.g., EPA oversight of the Lead Organization and its contractors/subcontractors), criteria to compare EPA-generated data with the data generated by the Lead Organization must be established and documented in the oversight QAPP prior to data collection.

Comparability criteria should be determined for each matrix, analytical parameter (and analyte, if applicable), and concentration level. Oversight split sampling comparability criteria must specify the following:

1. Acceptable percent difference (%D) for individual analyte comparisons (for combinations of nondetects, detects close to the QLs, and detects sufficiently greater than the QLs).
2. Acceptable percentage for number of analytes (per matrix, analytical parameter, and concentration level) with acceptable percent differences versus total number of percent differences (per matrix, analytical parameter, and concentration level).
3. The acceptable magnitude and direction of bias for comparisons performed in 1 and 2 above.
4. Acceptable overall comparability criteria for all data generated for use in the project.

Whenever split sampling is performed, a comparability flow diagram must be included in this section of the QAPP. An example of a flow diagram is provided in Diagram 2.

Diagram 2. Example: Data Comparison Flow Diagram and Criteria for Individual Aqueous Split Sample Results (generated using equivalent analytical methods and achieving equivalent QLs)



NOTES:
*%D - Percent Difference = $\left(\frac{C_1 - C_2}{\frac{C_1 + C_2}{2}} \right) \times 100\%$

RL = Reporting Limit is the Quantitation Limit adjusted for any necessary sample dilutions, sample volume deviations, and/or extract/digestate volume deviations.

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Field Screening/Confirmatory Split Sampling Data Comparability. Whenever full protocol analysis is performed to confirm field screening results, comparability criteria must be established and documented in the QAPP prior to data collection. Comparability criteria should be determined for each matrix, analytical parameter (and analyte, if applicable), and concentration level.

The comparability of field screening data generated on-site and split sample confirmation data generated in a fixed or field laboratory using conventional full-protocol analytical methods is the most important factor for determining whether field screening data will meet the project objectives and be usable for project decision-making. The conventional full-protocol analytical methods that are used to confirm field screening results must be scientifically valid and well-documented methods that have been routinely accepted by regulators, since data comparability decisions are based on a limited number of samples analyzed by those conventional full-protocol methods.

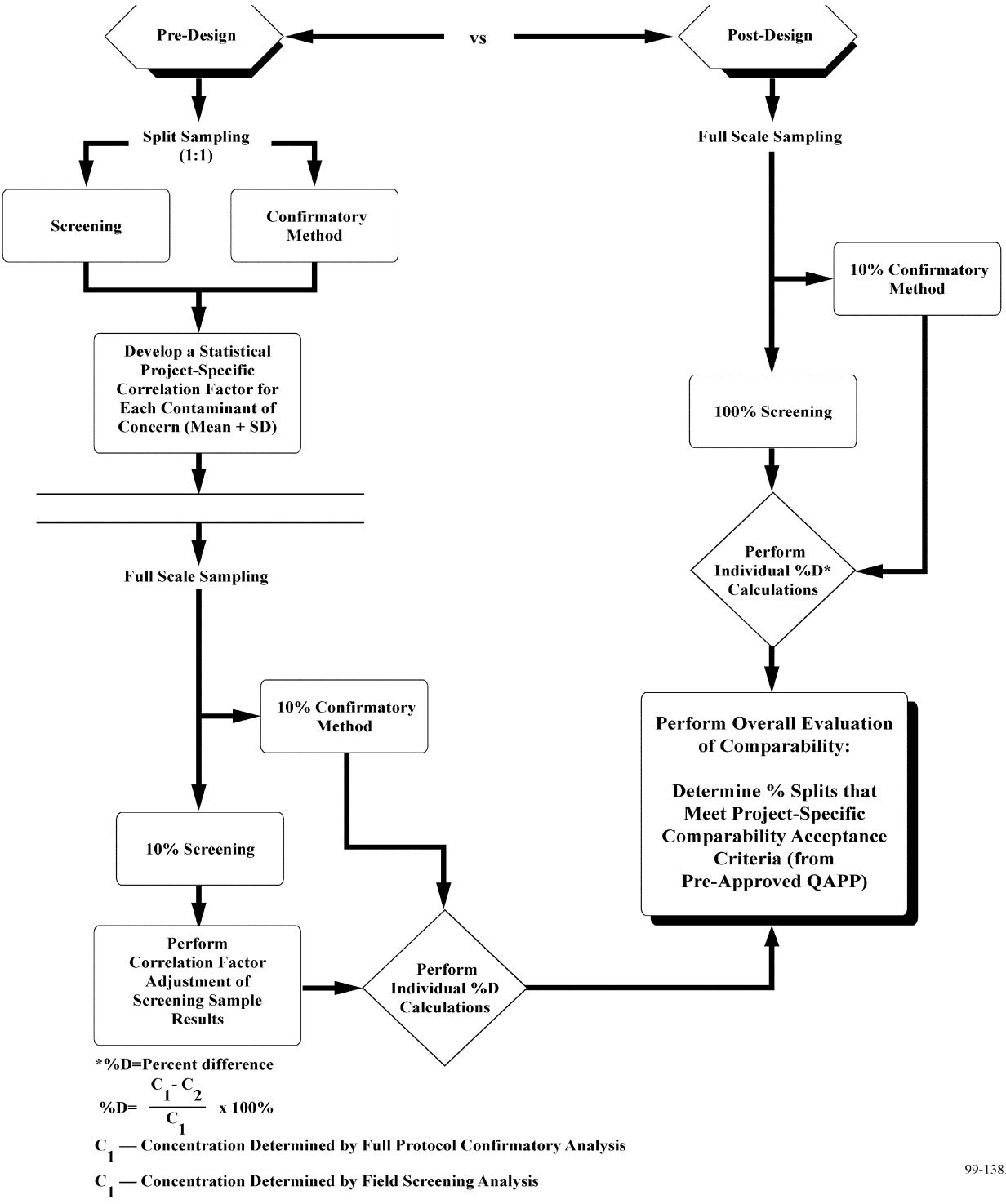
Diagram 3, Comparability Determination, illustrates two approaches that can be used for determining the comparability of field screening and confirmatory data. One approach involves the generation and application of predesign correlation factors to adjust field screening sample results prior to performing data comparability calculations. Correlation factor adjustment of field screening sample results can be critical when a one-to-one correlation does not exist for data generated with the field screening and confirmatory methods (depending on differences in methods selectivity, sensitivity, precision, and accuracy, as well as the relationship of the achievable quantitation limits to the project Action Limits).

The other approach does not use correlation factor adjustment of field screening sample results prior to performing data comparability calculations. Note that comparability calculations, performed with field screening and confirmatory data for which correlation factors have not been generated and/or applied, may result in project-specific comparability criteria being exceeded (especially if these criteria are tight).

Both approaches require that data comparability acceptance requirements be developed and documented in an approved project QAPP prior to initiation of field sampling activities.

When developing comparability acceptance criteria for field screening and confirmatory data, the following issues must be considered:

Diagram 3. Comparability Determination



- Are the screening and confirmatory methods based on the same analytical principles? If the screening and confirmatory methods measure target analytes using different principles, then a one-to-one correlation should not be assumed.
- Do the screening and confirmatory methods analyze for the same list of target analytes? If not, then a one-to-one correlation should not be assumed.
- Do the screening and confirmatory methods report to the same QL? If not, then how will data reported below the QL of either one of the methods be handled? Also, are the QLs for the screening and confirmatory methods significantly less than the project Action Limits?
- Do the screening and confirmatory methods have the same extraction efficiencies, use the same sample volumes, and perform similar sample pretreatment and sample cleanup? These differences may also account for correlations that are not one-to-one.
- How will percent moisture be accommodated for both screening and confirmatory samples?
- Are the calibration procedures the same for the screening and confirmatory methods; that is, will standard calibration curves be generated, or single point calibrations?

Field screening/confirmatory comparability criteria must specify the following:

1. Acceptable percent differences for individual analyte comparisons (for combinations of nondetects, detects close to the QLs, and detects sufficiently greater than the QLs).
2. Acceptable percentage for number of analytes (per matrix, analytical parameter, and concentration level) with acceptable percent differences versus total number of percent differences (per matrix, analytical parameter, and concentration level).
3. The acceptable magnitude and direction of bias for comparisons performed in 1 and 2 above.
4. Acceptable overall comparability criteria for all data generated for use in the project.

Whenever field screening/confirmatory split sampling is performed, a comparability flow diagram must be included in this section of the QAPP. Multiple flow diagrams may be needed to address QL differences between screening and full-protocol methods.

Sensitivity: Determine quantitative measurement performance criteria for acceptable sensitivity to ensure that QLs can be routinely achieved for each matrix, analytical parameter, and concentration level. Also determine analyte-specific measurement performance criteria, if applicable. Identify which QA/QC activities and/or QC checks or samples will be performed or analyzed to measure sensitivity.

Sensitivity is the ability of the method or instrument to detect the contaminant of concern and other target compounds at the level of interest. Method and instrument sensitivity may be evaluated by preparing and analyzing a Laboratory Fortified Blank (LFB). An LFB is a blank matrix that is spiked at the quantitation limit with the contaminants of concern. Sensitivity may be measured by calculating the percent recovery of the analytes at the quantitation limit.

Quantitation Limits: Document the project-required quantitation limits for each matrix, analytical parameter, concentration level, and analyte. Differentiate between project Action Limits and project-required quantitation limits. The Action Limit for a contaminant of concern or other target compound is the numerical value that causes the decision-maker to choose one of the alternate actions. It may be a regulatory threshold such as MCL, a risk-based concentration level, a reference-based standard, or a technological limitation. Because of uncertainty at the quantitation limit, project-specific QLs should be at least one-third of the Action Limit, and ideally one-tenth of the Action Limit. Refer to Diagram 4 for a representation of these relationships. Also differentiate between MDLs and QLs that are documented in a published analytical method and MDLs and QLs that an individual laboratory can routinely achieve.

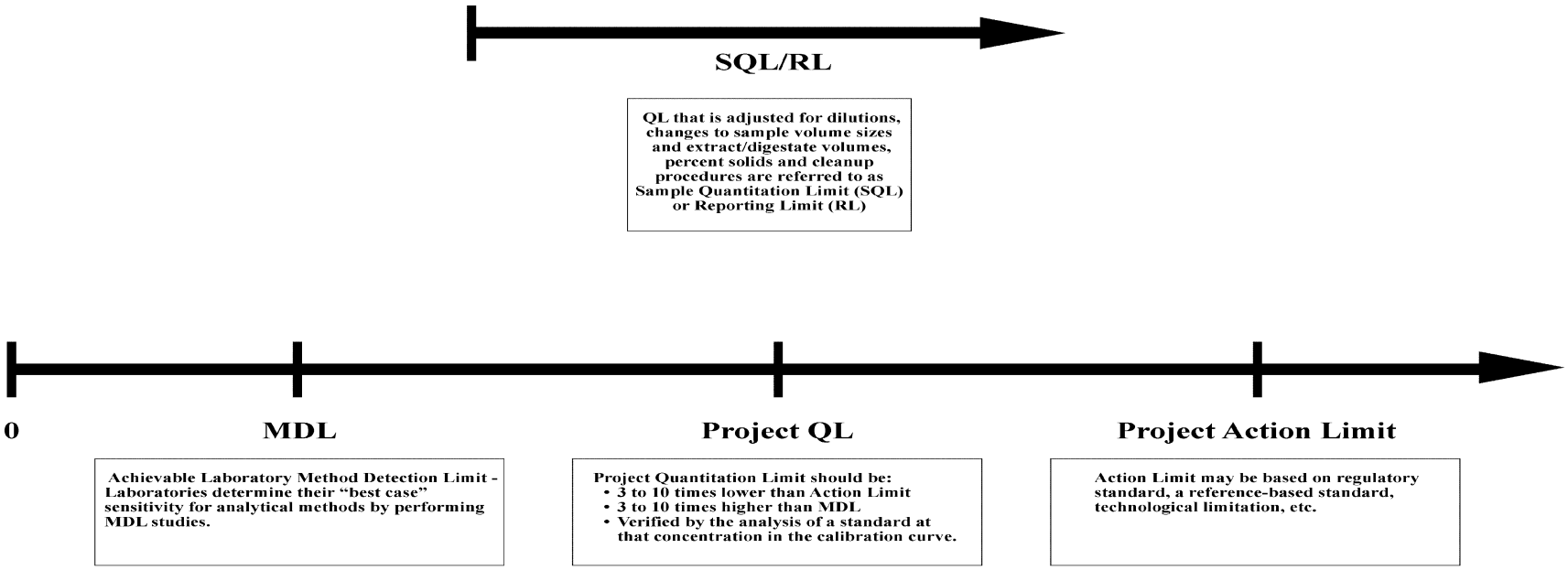
The following issues should be considered when selecting project-specific QLs:

- A laboratory MDL is a statistically derived detection limit and should be lower than the concentration at which the laboratory can quantitatively report. Laboratories determine their "best case" sensitivity for analytical methods by performing MDL studies.

- The QL is the minimum concentration of an analyte that can be routinely identified and quantified above the MDL by a laboratory. QLs should be at least 3 times the achievable laboratory MDL, and ideally 10 times the achievable laboratory MDL. Calibration curves should always include a standard concentration at the QL to ensure sensitivity. QLs are also known as practical quantitation limits (PQLs) and minimum levels (MLs).

- Frequently, QLs for specific samples must be adjusted for dilutions, changes to sample volume/size and extract/digestate volumes, percent solids, and cleanup procedures. These QLs are then referred to as sample quantitation limits (SQLs) or reporting limits (RLs). SQLs/RLs must be *less than* the project Action Limits for project quality objectives to be definitively met. Sample results that are reported to SQLs/RLs that are higher than the project Action Limits cannot be used to determine whether the Action Limit has been exceeded. Thus, environmental decision-making may be adversely affected by the failure to meet project QLs.

Diagram 4. Determining Project Quantitation Limits



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Completeness: The QAPP must address how completeness will be calculated. Determine quantitative measurement performance criteria for acceptable completeness for each matrix, analytical parameter, and concentration level. Also determine analyte-specific measurement performance criteria, if applicable. Identify which QA/QC activities will be performed to measure completeness.

Completeness is a measure of the amount of usable data collected using a measurement system. It is expressed as a percentage of the number of valid measurements that should have been collected. Separate values should be provided for the whole data set versus critical data (a subset of the whole data set). Since lack of data completeness may require resampling and additional costs, discuss how sufficient data will be guaranteed for critical sample locations.

Measurement Performance Criteria Table – Provide a Measurement Performance Criteria Table that contains the information in the example of OPTIONAL QAPP Worksheet #11.

Figure 11. Example: Measurement Performance Criteria Table

Figure 11. Example: Measurement Performance Criteria Table

Medium/Matrix	*Ground Water*
Analytical Parameter	*VOA*
Concentration Level	*Low*

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)[1]	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
S-1	*L-1*	*Precision-Overall*	*RPD#30% when VOC detects for both field duplicate samples are $ QL. RPD # 40% when gaseous VOC detects for both field duplicate samples are $ QL.*	*Field Duplicates*	*S+A*
		Precision-Lab	*RPD#20% when VOC detects for both laboratory duplicate samples are $ QL. RPD # 30% when gaseous VOC detects for both laboratory duplicate samples are $ QL.*	*Matrix Spike/Matrix Spike Duplicates*	*A*
		Accuracy/bias	*±20% VOCs except volatile gases ±40%*	*Matrix Spike/Matrix Spike Duplicates*	*A*
		Accuracy/bias	*No false negatives, no false positives, quantitation within warning limits (±2σ)*	*Single Blind PES*	*A*
		Accuracy/bias-Contamination	*No target compounds $ QL*	*Equipment Blanks, Trip Blanks, Method Blanks & Instrument Blanks*	*S+A*
		Sensitivity	*±40% @ QL*	*Laboratory Fortified Blank @ QL*	*A*

[1]**Data Quality Indicators (a.k.a. PARCC parameters, i.e., precision, accuracy/bias, sensitivity, data completeness, comparability)**

Figure 11. Example: Measurement Performance Criteria Table (continued)

Medium/Matrix	*Ground Water*
Analytical Parameter	*VOA*
Concentration Level	*Low*

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)[1]	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
S-1	*L-1*	*Data Completeness*	*85% Overall, 100% Critical Data*	*Data Completeness Check*	*S+A*
		Comparability	*This is the first of five rounds of sampling. Subsequent data will be compared to this data set. A criterion of 35% Difference for individual VOCs @ ≥ QL and a criterion of 45% Difference for individual gaseous VOCs @ ≥ QL will be used to compare individual analytes from those data sets.*	*Comparability Check*	*S+A*

[1]**Data Quality Indicators (a.k.a. PARCC parameters, i.e., precision, accuracy/bias, sensitivity, data completeness, comparability)**

After measurement performance criteria have been established, data generators and QA personnel can select sampling and analytical procedures/methods. They will select methods and procedures that have QC acceptance limits that support the achievement of established performance criteria. The determination of the analytical data validation criteria should be concurrent with the development of measurement performance criteria and the selection of sampling and analytical procedures/methods. Data users and QA personnel should select data validation criteria that support both the established project-specific measurement performance criteria and the analytical method/procedure QC acceptance limits. This will ensure that only data meeting project-required measurement performance criteria are used in decision-making.

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PART B. MEASUREMENT/DATA ACQUISITION ELEMENTS

This QAPP element group includes how project data will be collected, measured, and documented. Proper implementation of those activities/tasks will help to ensure that the resultant data are scientifically sound, of known and documented quality, and suitable for their intended use.

Quality control activities that will be performed during each phase of data collection/generation, from sampling to data reporting, are identified. QC acceptance limits are documented and the required corrective actions for nonconformances are described. It is important to remember that each phase of data collection/generation is interdependent and, therefore, quality must be factored into all project activities/tasks. The other two QAPP element groups, Assessment/Oversight and Data Validation and Usability, evaluate the activities/tasks described in this Measurement/Data Acquisition element group.

B.1 Sampling Tasks

The sampling sections of the QAPP include all components of the project-specific sampling system, including sampling process design and rationale, sampling procedures and requirements, as well as sample handling and custody requirements. **To simplify QAPP preparation, written SOPs should be included as attachments to the QAPP whenever possible.**

These sections of the QAPP should provide sufficient documentation to assure the reviewer that representative samples of the appropriate medium/matrix will be properly and consistently collected at the appropriate locations and that preventive and corrective action plans are in place prior to initiation of the sampling event. The terms “medium” and “matrix” are frequently used interchangeably. More accurately, however, medium refers to a substance (e.g., air, water, soil), whereas matrix refers to a specific type of medium (e.g., surface water, drinking water, etc.).

B.1.1 Sampling Process Design

This section of the QAPP describes the sampling system in terms of what media/matrices will be sampled, where the samples will be taken, the number of samples to be taken, and the sampling frequency. **Whether the QAPP describes an initial site investigation, a large-scale remedial investigation/feasibility study, a long-term treatment monitoring program, or a volunteer monitoring program, the rationale for sampling specific points or locations must be explained in the QAPP.**

B.1.1.1 Sampling Design Rationale

For each medium/matrix, provide detailed justification for the sampling design selected for the project, including background sample locations. Describe the logic used to determine sample locations, analytical parameters, and concentration levels, and the type, number, and frequency of field samples and field QC samples to be collected. Describe the following information pertaining to the sampling plan selection:

- If a grid system will be used to select random sampling locations, then describe the basis for selecting the size of the grid. If the grid system is to be used for long-term monitoring, or a high degree of accuracy is required, then the grid system should be surveyed by a certified land surveyor. Note that simple random sampling is used primarily when the variability of the medium is known to be relatively small (i.e., the medium is homogeneous).
- If biota will be sampled, describe the rationale for species and seasonal selection.
- If a watershed is being investigated, describe the rationale for sampling each medium and sample location.
- If surface water samples will be collected, describe the rationale for location selection.
- If field analytical measurements and/or screening techniques will be used to identify sample locations, provide decision trees that document the critical decision points of the selection process.
- If samples will be composited, provide the rationale and procedure for compositing.
- If a biased sampling approach will be used to select sampling locations, describe the rationale for choosing a nonstatistical approach.
- If biased/judgmental sampling will be performed, describe the criteria for selecting "hot spots."

Sampling Location Maps – Include additional site maps, charts, and plans to identify and document specific sample locations. Site maps must include the site borders, well boring, and test pit installations from previous investigations, as well as buildings, hills, water bodies, depressions, etc. and must identify all areas with known or suspected oil or chemical spills and/or toxic substance releases. The purpose of these maps is to allow unequivocal determination of sample locations.

Sampling Locations and Sampling and Analysis Methods/SOP Requirements Table – Provide a Sampling Locations and Sampling and Analysis Methods/SOP Requirements Table that contains the information shown in the example, OPTIONAL QAPP Worksheet #12b (Figure 12). Selected information from Sections B.1.2, B.2.1, and B.2.2 of the QAPP is needed to complete this table.

Figure 12. Example: Sampling Locations and Sampling and Analysis Methods/SOP Requirements Table

Figure 12. Example: Sampling Locations and Sampling and Analysis Methods/SOP Requirements Table

Sampling Location[1,2]	Location ID Number	Medium/ Matrix	Depth (units)	Analytical Parameter	Concentration Level	Number of Samples (identify field duplicates and replicates)	Sampling SOP	Analytical Method/SOP	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
MW-1[1,2]	*001*	*GW*	*20-25 (ft.)*	*VOA*	*Low*	*1*	*S-1*	*L-1*	*2 x 125 mLs*	*2 x 125 mL amber glass*	*HCl pH<2, 4°C, Light Protected*	*14 days for analysis*
				SVOC	*Low/Medium*	*1*	*S-2*	*L-2*	*2 Liters*	*2 x 1 Liter amber glass*	*Ice*	*7 days for extr. 40 days for anal.*
				Metals	*Low/Medium*	*1*	*S-2*	*L-3*	*1 Liter*	*1 X 1 Liter plastic*	*$HN0_3$ pH<2*	*28 days for Hg 180 days for others*
MW-2[1]	*002*	*GW*	*30-35 (in.)*	*VOA*	*Low*	*1 + 1 Field Dup.*	*S-1*	*L-1*	*4 x 125 mLs*	*4 x 125 mL amber glass*	*HCl pH<2, 4°C, Light Protected*	*14 days for analysis*
				SVOC	*Low/Medium*	*1 + 1 Field Dup*	*S-2*	*L-2*	*4 Liters*	*4 x 1 Liter amber glass*	*Ice*	*7 days for extr. 40 days for anal.*
				Metals	*Low/Medium*	*1 + 1 Field Dup*	*S-2*	*L-3*	*2 Liter*	*2 X 1 Liter plastic*	*$HN0_3$ pH<2*	*28 days for Hg 180 days for others*
MW-3[1]	*003*	*GW*	*30-35 (in.)*	*VOA*	*Low*	*1*	*S-1*	*L-1*	*2 x 125 mLs*	*2 x 125 mL amber glass*	*HCl pH<2, 4°C, Light Protected*	*14 days for analysis*
				SVOC	*Low/Medium*	*1*	*S-2*	*L-2*	*2 Liters*	*2 x 1 Liter amber glass*	*Ice*	*7 days for extr. 40 days for anal.*
				Metals	*Low/Medium*	*1*	*S-2*	*L-3*	*1 Liter*	*1 X 1 Liter plastic*	*$HN0_3$ pH<2*	*28 days for Hg 180 days for others*
MW-4[1]	*004*	*GW*	*25-30 (in.)*	*VOA*	*Low*	*1*	*S-1*	*L-1*	*2 x 125 mLs*	*2 x 125 mL amber glass*	*HCl pH<2, 4°C, Light Protected*	*14 days for analysis*
				SVOC	*Low/Medium*	*1*	*S-2*	*L-2*	*2 Liters*	*2 x 1 Liter amber glass*	*Ice*	*7 days for extr. 40 days for anal.*
				Metals	*Low/Medium*	*1*	*S-2*	*L-3*	*1 Liter*	*1 X 1 Liter plastic*	*$HN0_3$ pH<2*	*28 days for Hg 180 days for others*

[1]Indicate critical field sampling locations with "1".
[2]Indicate background sampling locations with "2".

B.1.2 Sampling Procedures and Requirements

This section of the QAPP describes how samples will be collected. The selected sampling procedures must be appropriate to ensure that representative samples are collected in a consistent manner by project personnel; that contamination is not introduced during collection; and that all required sample media/matrices, locations, and properly preserved volumes are collected to meet project objectives.

B.1.2.1 Sampling Procedures

Sampling SOPs – All sampling procedures that will be used in the project must be documented in the QAPP to allow for review and approval. Standardized sampling procedures provide consistency between samplers; facilitate collection of accurate, precise, and representative samples; and help to ensure data comparability and usability. While it may be possible to comprehensively describe the sampling procedures for small projects within the text of the QAPP, the most efficient and cost-effective way to document project-specific sampling techniques is to include sampling SOPs as attachments to the QAPP.

SOPs can be written and formatted in accordance with the *Guidance for the Preparation of Standard Operating Procedures (SOPs) for Quality-Related Documents*, November 1995, EPA/600/R-96/027 (EPA QA/G-6). In addition to a detailed step-by-step description of the sampling procedure, all SOPs must specify acceptable limits of performance and required corrective actions.

Include SOPs for sampling each medium or matrix, for each analytical parameter, by each type of equipment and technique. The SOPs must detail the appropriate number, size, and type of sample containers to be used for collection of each field sample and field QC sample and the proper temperature, light, and chemical preservation procedure for those samples.

Include SOPs for any planned contingency actions that require additional and/or alternate procedures. For example, include procedures for sampling high-moisture-content soils/sediments when those matrices potentially contain peat.

Provide a detailed description, explanation, and SOP for the use of all new and/or innovative sampling techniques that will be employed during the project. Provide documentation of the procedures as well as performance data and criteria to support the use of new/innovative techniques.

Examples of sampling SOPs include, but are not limited to:

- Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells

- SOPs for Soil Sampling during Monitoring Well Installation
- Sampling SOPs for Surface and Subsurface Soils
- SOPs for the Collection of Sediments
- SOPs for the Collection of Surface Water Samples from Lakes, Ponds, and Streams
- SOPs for the Collection of Drinking Water from Residential Homes
- Sampling SOPs for Ambient Air, Stack Gases, and Soil Gas
- SOPs for Collection of Samples from Waste Storage Tanks and Waste Drums
- Sample Compositing SOPs
- Split Sampling SOPs
- Equipment Cleaning SOPs
- Equipment Decontamination SOPs
- Field Equipment Calibration SOPs
- Field Equipment Maintenance, Testing, and Inspection SOPs
- SOPs for Inspection and Acceptance Requirements for Supplies

Project Sampling SOP Reference Table – Provide a Project Sampling SOP Reference Table that contains the information shown in the example in Figure 13.

Figure 13. Example: Project Sampling SOP Reference Table

Figure 13. Example: Project Sampling SOP Reference Table

Reference Number	Title, Revision Date, and/or Number	Originating Organization	Equipment Identification	Modified for Project Work Y or N	Comments
S-1	*EPA-NE Low Stress SOP, Rev. 2, July 30, 1996*	*Region I, EPA New England*	*Adjustable Rate, Submersible Pump with Teflon Tubing (1/4 inch ID)*	*N*	
S-2	*CE-Decontamination Procedures for Monitoring Well Equipment, Rev. 1, 1996*	*Chaucer Engineering (CE)*	*Submersible Pumps*	*N*	
S-3	*CE-Sample Packaging and Shipping Procedures, Rev. 4, 1995*	*Chaucer Engineering (CE)*	*Not Applicable*	*N*	
S-4	*CE-Chain-of-Custody Procedures and Field Documentation, Rev. 2, 1996*	*Chaucer Engineering (CE)*	*Not Applicable*	*N*	
S-5	*CE-Hazardous Waste Disposal Procedures, Rev. 1, 1996*	*Chaucer Engineering (CE)*	*Not Applicable*	*N*	

Note that all project sampling SOPs must be listed, including, but not limited to, sample collection, sample preservation, equipment cleaning and decontamination, equipment testing, inspection and maintenance, supply inspection and acceptance, and sample handling and custody SOPs.

B.1.2.2 Sampling SOP Modifications

If routine sampling SOPs are modified to meet project quality objectives, describe the modification(s) in this section of the QAPP and indicate, on OPTIONAL QAPP Worksheet #13 if used, that a modification occurred.

B.1.2.3 Cleaning and Decontamination of Equipment/Sample Containers

This section of the QAPP details both the procedures for the initial cleaning of sampling equipment *and* subsequent decontamination procedures that will be followed during the sampling event. These procedures help to ensure that collected samples are representative of the sampling location by verifying that sampling equipment is clean and free of contaminants of concern, other target compounds, and/or interferences. Cleaning/decontamination procedures must cover all equipment that contacts a sample.

Equipment Cleaning SOPs – Include equipment cleaning SOPs as attachments to the QAPP. Also, list these SOPs on the sampling SOP table. Initial equipment cleaning should address:

- How equipment will be cleaned initially prior to field activities
- Frequency at which equipment will undergo full cleaning protocols
- Criteria for measuring cleanliness

If precleaned bottles are used, the QAPP should identify the vendor and describe where the certificates of cleanliness will be maintained.

Equipment Decontamination SOPs – Include equipment decontamination SOPs as attachments to the QAPP. Also, list these SOPs on the sampling SOP table. Decontamination procedures for each type of equipment should address:

- How equipment will be decontaminated in the field
- Frequency at which equipment will be decontaminated
- Criteria for measuring the effectiveness of the decontamination procedures
- Disposal of decontamination by-products, if applicable

Discuss or include a table identifying *all* the equipment that will come in contact with each sample for each medium/matrix. The following table provides an example.

Equipment	Matrices			
	Soil	Sediment	Groundwater	Surface Water
Split Spoon Sampler	X			
Eckman Dredge		X		
Submersible Pump			X	
Kemperer Tube				X

If applicable, discuss or include a table identifying equipment that will come into contact with each sample for each medium/matrix and for a specific analytical parameter. The following table provides an example.

Matrix: Soil Equipment	Parameter		
	VOA	Semivolatile	Metals
Encore Sampler	X		
Split Spoon Sampler		X	X
Stainless Steel Bowl		X	X
Plastic Scoop			X

B.1.2.4 Field Equipment Calibration

This section of the QAPP ensures that all field equipment, including tools, gauges, pumps, etc., is calibrated to ensure performance within specified limits and to ensure that corrective action measures are taken to fix problems prior to and during field operations. This section of the QAPP demonstrates the ability of the equipment to collect representative samples and data during field operations.

Include field equipment calibration procedures as an attachment to the QAPP. Calibration of field equipment should follow EPA procedures where appropriate.

Field Sampling Equipment Calibration Table – Provide a Field Sampling Equipment Calibration Table that contains the information described in OPTIONAL QAPP Worksheet #14. All field equipment other than analytical instrumentation must be listed, including but not limited to tools, gauges, and pumps. An example of a completed Field Sampling Equipment Calibration Table is provided in Figure 14.

Figure 14. Example: Field Sampling Equipment Calibration Table

Figure 14. Example: Field Sampling Equipment Calibration Table

Equipment	Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference*
Type S Pitot	*40 CFR Part 60, Appendix A, Method 2*	*Every 6 months*	*As per 40 CFR Part 60, Appendix A, Method 2*	*Replace if criteria exceeded*	*Jane Airway*	*S-10*

*** Specify appropriate reference letter/number from the Project Sampling SOP Reference Table (see OPTIONAL QAPP Worksheet #13).**

B.1.2.5 Field Equipment Maintenance, Testing, and Inspection Requirements

This section of the QAPP describes the procedures and documentation activities that will be performed to ensure that field and sampling equipment are available and in working order when needed.

Equipment maintenance logs must be kept and equipment must be checked prior to use. Describe the records that will be kept to document field equipment maintenance, testing, and inspection activities.

Discuss the availability of spare parts and/or equipment to ensure that project schedules are met.

Field Equipment Maintenance, Testing, and Inspection Table – Provide a Field Equipment Maintenance, Testing, and Inspection Table that contains the information described in OPTIONAL QAPP Worksheet #15. An example of a completed Field Equipment Maintenance, Testing, and Inspection Table is provided in Figure 15.

Figure 15. Example: Field Equipment Maintenance, Testing, and Inspection Table

Figure 15. Example: Field Equipment Maintenance, Testing, and Inspection Table

Sampling Equipment/ Instrument	Maintenance Activity	Testing Activity	Inspection Activity	Responsible Person	Frequency	Acceptance Criteria	Corrective Action	SOP Reference*
Submersible Pump			*Visual inspection for defective parts*	*James Keller*	*Each pump prior to use*	*No visually defective parts*	*Use backup pump*	*S-1*
Submersible Pump		*Operation*		*James Keller*	*Each pump prior to use*	*Pump is operable*	*Repair if not operable*	*S-1*
Submersible Pump	*Cleaning*			*James Keller*	*Each pump prior to use*	*No visually dirty parts*	*Reclean*	*S-1*
Submersible Pump		*Equipment Blank (EB)*		*James Keller*	*Collect an EB prior to sampling of 2nd sampling location*	*No contaminants of concern and/or other target compounds detected at or above Quantitation Limit and no interferences detected.*	*If EB contamination levels impact data usability, then reclean, retest, and resample and/or qualify data during data validation.*	*S-1*

*** Specify appropriate reference letter/number from the Project Sampling SOP Reference Table (see OPTIONAL QAPP Worksheet #13).**

B.1.2.6 Inspection and Acceptance Requirements for Supplies/Sample Containers

This section of the QAPP documents the procedures and activities that will be performed to ensure that all sampling supplies and sample containers are free of contaminants of concern, other target compounds, and interferences.

Itemize the supplies and sample containers that will be used when performing field activities, including sampling activities. Identify all vendors for supplies and sample containers.

Describe the procedures that will be used to ensure that adequate supplies and sample containers are on hand and sample containers are traceable and clean. Discuss procedures for tracking, storing, and recording supplies and lot numbers for sample containers, as well as procedures for verifying container cleanliness, such as bottle blank analysis. Document the frequency of inspection activities, acceptance criteria, and corrective action procedures employed to prevent the use of unacceptable supplies and/or sample containers. Identify the personnel responsible, by job function and organizational affiliation, for checking supplies, sample containers, and sample container certificates of cleanliness, and the personnel responsible for implementing corrective actions. The required information may be presented in a table similar to OPTIONAL QAPP Worksheet #15. If this information is contained in an SOP, then cite the SOP reference number and include the SOP as an attachment to the QAPP.

B.1.3 Sample Handling, Tracking, and Custody Requirements

B.1.3.1 Sample Collection Documentation

This section of the QAPP describes field documentation procedures that will be followed for the project. Field analytical and fixed laboratory documentation procedures are discussed in Section B.5.1, in conjunction with data management and project records. Proper field sampling documentation, and field analytical and laboratory documentation, help to ensure sample authenticity (i.e., the sample identity is correct) and data integrity.

B.1.3.1.1 *Field Notes*

To provide a permanent record of field activities and possible introduction of sampling error, observations made and measurements taken in the field must be recorded. Typically, field data are recorded in field logbooks or on field data collection forms.

The following information should be included in the field logbooks/field data collection forms:

- Site name and location
- Sample project identification number
- Names, job functions, and organizational affiliations of personnel on-site
- Dates (month/day/year) and times (military) of all entries made in logbooks/forms, and user signatures
- Descriptions of all site activities, including site entry and exit times
- Site location by longitude and latitude centroid, if known
- Weather conditions, including temperature and relative humidity
- Site observations
- Identification and description of sample morphology and collection locations
- Sample collection information, including dates (month/day/year) and times (military) of sample collections, sample collection methods and devices, station location numbers, sample collection depths/heights, sample preservation information, sample pH (if applicable), analysis requested (analytical parameters), etc., as well as chain-of-custody information such as sample location identification numbers cross-referenced to field sample numbers
- Laboratories receiving samples and shipping information, such as carrier, shipment time, number of sample containers shipped, and analyses
- Contractor and subcontractor information (address, names of personnel, job functions, organizational affiliations, and contract number, contract name, and work assignment number)
- Records of photographs taken
- Site sketches and diagrams made on-site

Describe the field information that will be recorded for each medium/matrix and each type of sampling procedure, since field information is medium/matrix and procedure dependent. For example, documentation of monitoring well sample collection should provide documented information that includes screen interval, pump intake, purge rate, purge volume, temperature, relative humidity, specific conductance, pH, redox potential, dissolved oxygen, and turbidity. (An example of the Well Purging – Field Water Quality Measurements Form is provided in Appendix 4). For a soil boring, the documented field information should include drilling method, borehole diameter, ground elevation, water level, and soil descriptors like color, odor, and grain size. (examples of the Soil Boring Log forms are included in Appendix 4).

If field data collection forms will be used, include examples of the forms as figures in this section of the QAPP. Alternatively, include the examples as attachments to the QAPP and reference the appropriate attachment.

If field notebooks will be used, then include the requirements for the notebooks in this section. Bound notebooks with water-resistant, sequentially numbered pages and indelible ink entries should be required.

Regardless of the means of recording sampling information, copies of field data records should be included with the associated Data Validation Reports to facilitate the identification of sampling error.

B.1.3.1.2 *Field Documentation Management System*

Describe the field documentation tracking and management system as a part of the overall project data tracking and management system, which is described in Section B.5.1. The title of each notebook should indicate its function, and each notebook used for a specific site or project should be referenced to all the other project notebooks, including the Project Manager's daily log. Also, each notebook should be tracked and archived with other project records in accordance with the project data management system.

B.1.3.2 Sample Handling and Tracking System

This section of the QAPP documents the procedures that will be followed to identify and track samples collected in the field, samples analyzed in the field, and samples delivered or shipped to a fixed laboratory for analysis, as well as sample transfer throughout the laboratory. If samples are shipped to a fixed laboratory(s), then the laboratory's sample handling and tracking system should be described in this section. Proper sample tracking systems support the chain-of-custody procedures, which, in turn, help to ensure sample authenticity and data defensibility.

Define the term "sample" or reference the regulatory definition. Since the definition of sample is program-dependent, ensure the correct usage of the term. If a soil sample is operationally defined in the field by mesh size, then this should be noted. Also, if a laboratory subsamples a field sample based on certain criteria (e.g., mesh size), then those activities and definitions should be documented in this section of the QAPP.

Describe the sample numbering system for field sample collection and provide an example. If applicable, the numbering system should follow specific programmatic requirements that apply to the project. Use a systematic approach for numbering samples so that each sampling location, medium/matrix type, sample depth or height, and date/time of collection can be uniquely identified and cross-referenced to the programmatic sample number, if applicable.

Describe the laboratory sample tracking procedures. If laboratory identification numbers will be used to track samples internally, then the laboratory procedure must describe how these laboratory identification numbers will be cross-referenced with the sample number assigned in the field.

Describe temperature and preservation (including light protection) procedures that maintain sample integrity in the field prior to and during shipment to the laboratory.

Describe temperature and preservation (including light protection) procedures that maintain sample integrity immediately upon receipt by the fixed laboratory or mobile field laboratory.

Describe sample storage procedures used by the fixed laboratory or mobile field laboratory.

Sample Container, Volume, and Preservation Table – Document all required sample volumes, container types, numbers of containers, and preservation procedures (temperature, light, chemical) for each analytical parameter, matrix, and concentration level in a table.

Define how samples will be batched or grouped to be sent to the laboratory. It is recommended that samples be grouped in Sample Delivery Groups (SDGs). An SDG is defined as a group of 20 or fewer field samples within a project, received by a laboratory over a period of up to 14 calendar days. Performance evaluation samples (PESs) and other field QC samples (e.g., equipment blanks, VOA trip blanks) are counted as field samples in the 20-sample SDG total.

Describe how samples will be delivered or shipped to the laboratory. Include the name of the carrier service, if applicable. Samples should be transported directly to the laboratory within 24 hours of sample collection, or be shipped by an overnight delivery service (with coolers under custody seal) within 24 hours of sample collection. A major exception to this requirement is when published analytical holding times are less than 24 hours from sample collection. If alternate shipment schedules will be used, describe those alternate timeframes and provide rationale for their use.

Shipment papers, including bills of lading and airbills, must be retained by the laboratory with chain-of-custody records.

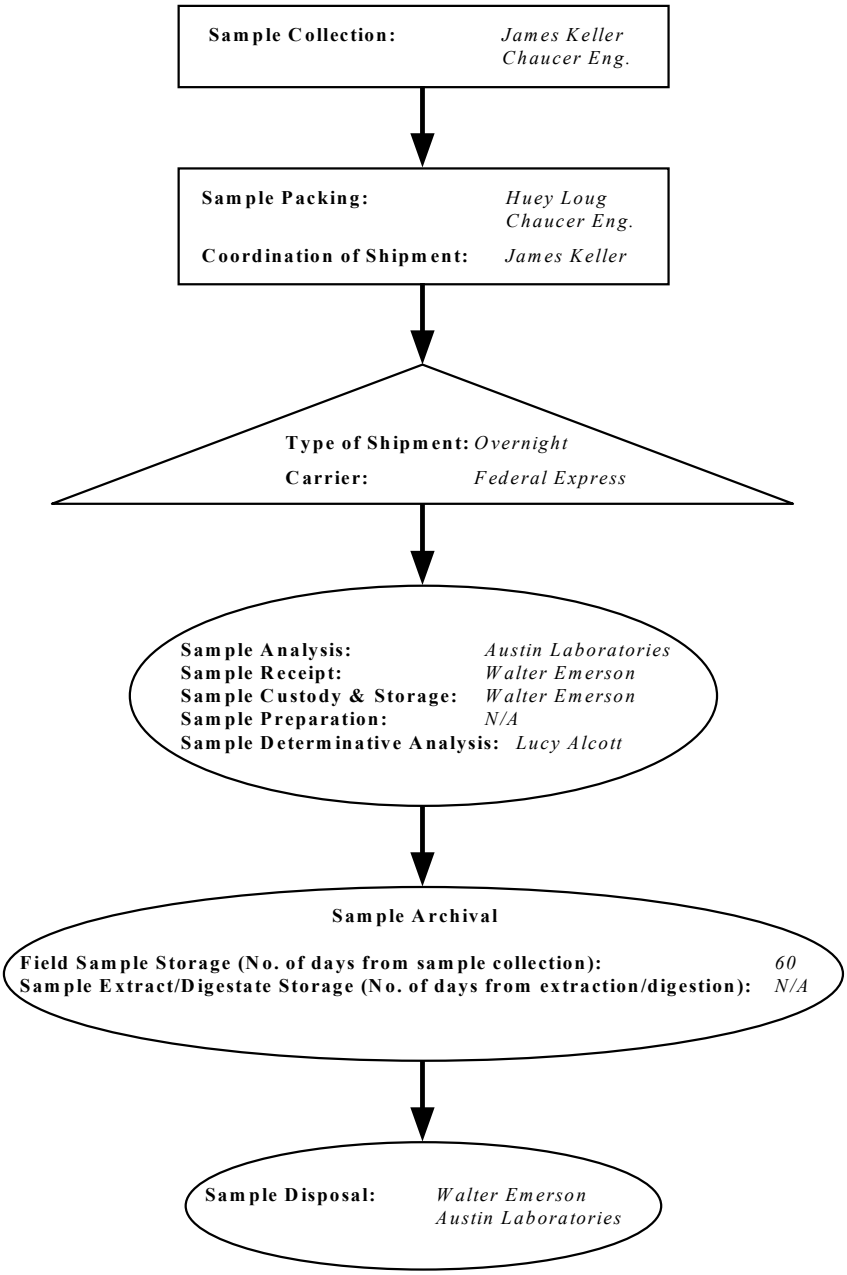
Include provisions for packaging, marking/labeling, and shipping samples in compliance with the most recent U.S. Department of Transportation (DOT) regulations for shipping hazardous and nonhazardous materials. Air carriers that transport hazardous materials require compliance with the current edition of the International Air Transport Association (IATA) Dangerous Goods Regulations, which applies to shipment and transportation of hazardous materials by air carriers. Following IATA regulations will also ensure compliance with U.S. DOT regulations.

Include examples of all sample shipment forms to be used (these may be the same as the chain-of-custody forms, which are discussed in Section B.1.3.3 of this Manual.)

Sample Handling Flow Diagram – Provide a flowchart that diagrams the flow of samples from the time of collection to laboratory delivery to final sample disposal. Indicate the personnel, and their organizational affiliations, who are primarily responsible for ensuring proper sample handling, custody, storage, and disposal. Specify the length of time that samples, digestates and/or extracts, and biological collections will be retained by the laboratory prior to disposal. An example of a Sample Handling Flow Diagram is provided in Figure 16.

Figure 16. Example: Sample Handling Flow Diagram

Figure 16. Example: Sample Handling Flow Diagram



Sample Container Label (Sample Tag) – Specify the required sample label information in this section and include an example of a sample container label. Sample containers should be labeled, using indelible ink, with the following minimum information:

- Site name and location
- Sample project identification number
- Sample collection location and depth/height
- Collection date (month/day/year) and time (military)
- Sample collection method (composite or grab) and device
- Sample preservation method (chemical or physical, e.g., ice; indicate if sample must be light protected)
- Sample pH, if applicable
- Analysis requested (analytical parameter)
- Sampler's signature

Describe how the information on the label will be preserved, such as covering the label with clear tape to minimize water damage during transit.

B.1.3.3 Sample Custody

A sample is in "custody" if it is in the actual physical possession of authorized personnel or in a secured area that is restricted to authorized personnel. For some projects, an evidentiary paper trail documenting sample custody is required to meet project quality objectives. Since it is often difficult to predict what samples and/or projects will require proof of custody after the fact, all data collection events should employ standard chain-of-custody procedures and documentation to ensure data authenticity and defensibility.

This section of the QAPP describes the procedures that will be used to maintain sample custody and integrity and to document implementation of proper chain-of-custody procedures. The evidentiary trail from sample collection through data generation and archival is maintained using sample custody procedures and documented by complete chain-of-custody records, including chain-of-custody forms, traffic reports, sample tags/labels, cooler custody seals, sample custody seals, laboratory sample receipt forms, laboratory sample transfer forms, etc. Note that only through complete documentation can the end user prove that the individual sample results are reflective of a particular sample (collected at a specific site location on a unique date and time) and that the sample was handled as prescribed. Chain-of-custody procedures ensure accountability for the location and integrity of the sample at all times. Refer to the EPA policy document, *National Enforcement Investigations Center (NEIC) Policies and Procedures* (EPA-330/9-78-001-R, May 1978), Rev. December 1981, for information regarding chain-of-custody procedures.

Include the field sampling team's procedures for maintaining and documenting sample custody from the time samples are collected in the field through packaging, shipment, and delivery to the laboratory. Field sampling documents that describe chain-of-custody procedures, including SOPs, should be included as an attachment to the QAPP.

Include the laboratory's procedures for maintaining and documenting sample custody from the time the samples are received at the laboratory through archival and disposal. Laboratory documents that describe the chain-of-custody procedures should be included as an attachment to the QAPP.

Chain-of-Custody Documentation – Include examples of all chain-of-custody documentation, including chain-of-custody forms, traffic reports, sample tags/labels, custody seals, laboratory sample receipt forms, laboratory sample transfer forms, etc., that will be used during the project.

An example of a Chain-of-Custody Record is provided in Appendix 4.

Sample Handling, Tracking, and Custody SOPs – Include as attachments to the QAPP all sample handling, tracking, and custody procedures that ensure that sample integrity/custody is maintained during sample collection, packaging, handling, and shipping, through laboratory sample receipt, archival, and disposal. List sampling chain-of-custody SOPs on the Project Sampling SOP Reference Table (see OPTIONAL QAPP Worksheet #13 for an example). List COC SOPs associated with field or fixed laboratory analysis on the Field Analytical Method/SOP Reference Table or the Fixed Laboratory Analytical Method/SOP Reference Table (see OPTIONAL QAPP Worksheets #17 and #20, respectively, for examples).

Examples of sample handling, tracking, and custody SOPs include, but are not limited to:

- Field Documentation SOPs and Records Management SOPs
- Sample Custody/Sample Security SOPs (field)
- Sample Handling and Tracking SOPs (field)
- Sample Packaging and Shipping SOPs (field)
- Sample Receipt and Storage SOPs (laboratory)
- Sample Custody/Sample Security SOPs (laboratory)
- Sample Tracking SOPs (laboratory)
- Sample Disposal or Archival SOPs (laboratory)

B.2 Analysis Tasks

The following sections of the QAPP include all components of the project-specific analytical measurement system, including field and fixed laboratory analytical methods and SOPs; method-

and laboratory-specific QC measurements, acceptance criteria, and corrective actions; calibration procedures; and instrument/equipment/supply maintenance, testing, and inspection requirements.

Field analytical tasks are those analytical activities that are not performed in a fixed laboratory. Field analysis includes both semiquantitative/semiqualitative field screening techniques and definitive full-protocol analytical methods. Definitive data may be generated for field parameters, including specific conductance, temperature, DO, pH, turbidity, and ORP/Eh using field instrumentation. Definitive inorganic and organic data may be generated in a mobile field laboratory equipped with a GC, GC/MS, ICP, etc.

These sections of the QAPP should provide sufficient documentation to assure the reviewer that accurate, precise, and usable data will be generated and that preventive and corrective action plans are in place prior to the initiation of the sampling event.

All contracted and/or subcontracted field analytical and fixed laboratory services must be in place for the final QAPP to be approved.

Where regulatory and/or programmatic requirements specify that a laboratory be certified (e.g., EPA water supply program), documentation of the laboratory certification must be included as an attachment to the QAPP.

B.2.1 Field Analytical Method Requirements

This section of the QAPP describes the analytical techniques that will be used in the field or by an on-site mobile laboratory to generate screening data as well as definitive data for the project. It documents the field analytical methods and SOPs that will be used to meet measurement performance criteria and achieve project-required quantitation limits for the contaminants of concern and other compounds at the target concentration levels and in the specific media/matrices. Note the difference between methods and analytical SOPs: methods describe preparatory and analytical/determinative techniques used in target analyte identification and quantitation, while analytical SOPs document how a particular laboratory will perform a specific analytical method.

B.2.1.1 Field Analytical Methods and SOPs

Field Analytical Methods and SOPs – All field analytical methods and procedures that will be used in the project must be documented in the QAPP to allow for review and approval. Differentiate between field screening procedures and field analytical procedures used to generate definitive data. While it may be possible to describe simple field analytical procedures within the text of the QAPP, the most efficient and cost-effective way to document project-specific measurement procedures is to include analytical methods and SOPs as attachments to the QAPP. Include methods/SOPs for each analytical parameter, medium/matrix, and concentration level that will be investigated. All methods/SOPs must contain the maximum allowable holding time from sample collection to sample preparation and/or analysis (as appropriate).

If definitive data will be generated using a mobile on-site laboratory, then the organization operating that mobile laboratory must provide the equivalent of a Laboratory QA Plan/Manual, to be included as an attachment to the QAPP if definitive data are generated. This document may not be necessary if only field screening data are being generated. However, the SOPs for the screening methods must be referenced in the QAPP and be available to the personnel performing the screening and upon request.

Analytical methods should be written and formatted in accordance with the Environmental Monitoring Management Council (EMMC) Method Format (which is provided in Appendix 5). Analytical methods must specify appropriate QC checks and samples with explicit concentration and frequency requirements for preparation and analysis, QC acceptance limits, and required corrective actions for each step of the method.

Analytical SOPs should be written and formatted in accordance with the *Guidance for the Preparation of Standard Operating Procedures (SOPs) for Quality-Related Documents*, November 1995, EPA/600/R-96/027 (EPA QA/G-6). In addition to a detailed step-by-step description of the procedure, all SOPs must specify appropriate QC checks and samples with explicit concentration

and frequency requirements for preparation and analysis, QC acceptance limits, and required corrective actions for each step of the procedure.

Include analytical methods and SOPs for any planned contingency analytical work that may be required.

Provide a detailed description, explanation, and SOP for the use of all new and/or innovative analytical techniques that will be employed during the project. Provide documentation of the procedures as well as method performance data and criteria to support the use of new/innovative techniques.

Examples of field analytical methods and SOPs include, but are not limited to:

- EPA Standard Methods
- Field Analytical SOPs
- Sample Receipt and Storage SOPs
- Sample Tracking SOPs
- Sample Preparation SOPs
- Glassware Cleaning SOPs
- Calibration SOPs
- Maintenance, Testing, and Inspection Activities SOPs
- Analytical Standards Preparation and Traceability SOPs
- Data Reduction Procedures
- Documentation Policies/Procedures
- Data Verification Procedures
- Data Management Procedures
- Sample and Sample Extract/Digestate Disposal SOPs

Field Analytical Method/SOP Reference Table – Provide a Field Analytical Method/SOP Reference Table that contains the information described in OPTIONAL QAPP Worksheet #17. An example of a completed Field Analytical Method/SOP Reference Table is provided in Figure 17.

Figure 17. Example: Field Analytical Method/SOP Reference Table

Figure 17. Example: Field Analytical Method/SOP Reference Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Originating Organization	Analytical Parameter	Instrument	Organization Performing Field Analysis	Modified for Project Work Y or N
F-1	*CE-Procedure for Calibrating Field Instrumentation, Oct. 1997*	*Definitive*	*Chaucer Engineering (CE)*	*pH*	*pH Probe*	*Chaucer Engineering (CE)*	*N*
				DO	*DO Probe*	*Chaucer Engineering (CE)*	*N*
				Specific Conductance	*Specific Conductance Electrode*	*Chaucer Engineering (CE)*	*N*
				Temperature	*Temperature Sensor*	*Chaucer Engineering (CE)*	*N*
				Turbidity	*Turbidimeter*	*Chaucer Engineering (CE)*	*N*
				ORP/Eh	*ORP/Eh Electrode*	*Chaucer Engineering (CE)*	*N*

B.2.1.2 Field Analytical Method/SOP Modifications

If full-protocol methods or other published methods and/or standard SOPs are modified to meet project quality objectives, then describe those modification(s) in this section of the QAPP. For example, a field screening analytical SOP for analyzing PCBs in soil requires that 1 gram of soil be extracted. If previously collected site data showed high levels of PCB contamination (i.e., above the calibrated measurement range), then the data generators may choose to extract a smaller volume of sample. This would constitute a modification to the SOP.

B.2.1.3 Field Analytical Instrument Calibration

To ensure that the analytical methods and the selected instrumentation meet the project requirements for selective, sensitive, accurate, and precise detection and quantitation of the analytes of interest, it is necessary to completely describe the calibration procedures for each field analytical instrument. This section of the QAPP demonstrates the ability of the field analytical technique to accurately and precisely identify and quantitate the contaminants of concern and other target compounds at the required quantitation limits and within the required measurement ranges.

Field Analytical Instrument Calibration Table – Provide a Field Analytical Instrument Calibration Table that lists all field analytical instrumentation (including, but not limited to, screening instruments, XRF, total organic vapor analyzers (PID or FID), portable GCs, and immunoassay kits) and contains the information shown in OPTIONAL QAPP Worksheet #18. An example of a completed Field Analytical Instrument Calibration Table is provided in Figure 18.

All instruments must be calibrated according to a schedule specified by the method and instrument manual or SOPs.

Figure 18. Example: Field Analytical Instrument Calibration Table

Figure 18. Example: Field Analytical Instrument Calibration Table

Instrument	Activity	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference*
pH Probe	*Calibrate probe with 3 temp. equilibrated stds. to bracket expected pH values.*	*-Daily - before use -Calibration check every 4 hours of use and at end of day*	*3 stds. provide stable readings ±0.1 pH unit within 3 min.*	*If probe reading fails to stabilize, do not use. Check/replace membrane and recalibrate or service as necessary. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.*	*James Keller*	*F-1*
DO Probe	*Calibrate with 2 stds - % Saturated DO std. and 0.0 mg/L DO std.*	*-Daily - before use -Calibration check every 4 hours of use and at end of day*	*± 0.2 mg/L for 0.0 mg/L DO std.*	*If DO reading exceeds criterion, then prepare new 0.0 mg/L DO std., clean probe and/or change membrane. Recalibrate or service as necessary. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.*	*James Keller*	*F-1*
Conductivity Meter	*Calibrate electrode with 1 std.*	*-Daily - before use -Calibration check at end of day*	*±1 Fmho/cm of std.*	*If sp. conductance reading exceeds criterion, then clean probe or service as necessary and recalibrate. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.*	*James Keller*	*F-1*
Thermistor-Temperature Sensor	*Calibrate against NIST certified thermometer*	*-Daily - before use -Calibration check at end of day*	*±0.15EC of NIST certified thermometer*	*If temperature sensor reading exceeds criterion, service or replace as necessary and recalibrate. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.*	*James Keller*	*F-1*
Turbidimeter	*Calibrate with 0.02 NTU and 2 other stds. to bracket expected sample concentration range*	*-Daily - before use -Calibration check at end of day*	*±5% per scale*	*If turbidity reading exceeds criterion, then recalibrate or service as necessary. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.*	*James Keller*	*F-1*
ORP/Eh Electrode	*Calibrate against 1 Zobell solution*	*-Daily - before use -Calibration check at end of day*	*±1 mv of std.*	*If ORP/Eh reading exceeds criterion, then have manufacturer recalibrate. Repeat analysis of affected samples or qualify data if analysis cannot be repeated.*	*James Keller*	*F-1*

*** Specify appropriate reference letter/number from Field Analytical Method/SOP Reference Table (see OPTIONAL QAPP Worksheet #17).**

Calibration procedures may be documented separately in this section of the QAPP or included in the appropriate field analytical SOPs as attachments to the QAPP. In either case, the following items, where appropriate, must be addressed for each analytical procedure:

- Frequency of initial and continuing calibrations.
- Number of calibration points, calibration levels for multipoint curves, and calibration standards at the required quantitation limit concentration for each contaminant of concern and other target compounds.
- Linearity calculation techniques.
- Acceptance criteria for calibrations.
- Calibration level for calibration verification standards. In order to assess instrument drift, a calibration verification standard should be run periodically during the analytical sequence and at the end of the analytical sequence.
- Corrective actions for nonconformances.
- Calibration/Standards Documentation: Describe what documentation will be generated for calibrations and standards for each instrument. Note that a plot for each regression curve must be provided for all nonlinear curves that will be used to quantitate field samples.
- Standards Traceability: Describe the procedures to be used to ensure standard traceability. Standards must be traceable to a verifiable source such as a NIST standard. Standards may be purchased as ampulated mixtures with certificates of analysis; however, it is the laboratory's responsibility to ensure the accuracy of the standard solutions.
- Second Source Verification: Describe the use of second source verification standards. Even certified standards may change over time or not meet vendors' specifications. A relatively inexpensive way to verify the analytes and concentration of a standard is to analyze a standard containing the same analytes from another vendor. By applying routine comparability criteria, greater assurance is gained in the identification and quantitation of target analytes in an analytical sample. The data from the two standards can be compared using previously established comparability criteria to assess accuracy.

B.2.1.4 Field Analytical Instrument/Equipment Maintenance, Testing, and Inspection Requirements

This section of the QAPP describes the procedures and documentation activities that will be performed to ensure that all field analytical instrumentation and equipment are available and in working order when needed.

Instrument/equipment maintenance logs must be kept, and instrumentation and equipment must be checked prior to use. Describe the records that will be kept to document field analytical equipment/instrumentation maintenance, testing, and inspection activities.

Discuss the availability of spare parts or spare instruments to ensure that project schedules are met. Discuss how instruments are controlled in the field and during storage, instrument security, and log-in/log-out procedures to ensure instrument availability.

Field Analytical Instrument/Equipment Maintenance, Testing, and Inspection Table – Provide a Field Analytical Instrument/Equipment Maintenance, Testing, and Inspection Table that contains the information described in OPTIONAL QAPP Worksheet #19. An example of a completed Field Analytical Instrument/Equipment Maintenance, Testing, and Inspection Table is provided in Figure 19.

Figure 19. Example: Field Analytical Instrument/Equipment Maintenance, Testing, and Inspection Table

Figure 19. Example: Field Analytical Instrument/Equipment Maintenance, Testing, and Inspection Table

Instrument	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Method/SOP Reference*
pH Probe	*Clean probe*			*When unstable readings occur*	*Stable after 3 min.*	*Clean probe, and/or replace membrane, and/or replace or service other defective parts*	*James Keller*	*F-1*
		QC Check		*Every 4 hours*	*±0.1 pH unit*			
			Visual Inspection	*Daily before use*	*No defective parts noted*			
DO Probe	*See SOP F-1*							*F-1*
Conductivity Meter	*See SOP F-1*							*F-1*
Temperature Sensor	*See SOP F-1*							*F-1*
Turbidimeter	*See SOP F-1*							*F-1*
ORP/Eh Electrode	*See SOP F-1*							*F-1*

*** Specify appropriate reference letter/number from Field Analytical Method/SOP Reference Table (see OPTIONAL QAPP Worksheet #17).**

B.2.1.5 Field Analytical Inspection and Acceptance Requirements for Supplies

This section of the QAPP documents the procedures and activities that will be performed to ensure that all supplies used in field analytical work will be available when needed and will be free of contaminants of concern, other target compounds, and interferences.

Itemize the supplies that will be used when performing field analytical work. Identify all vendors for supplies and reagents.

Describe the procedures that will be used to ensure supply cleanliness and reagent purity. Discuss procedures for recording reagent lot numbers and procedures for measuring supply cleanliness. Document corrective action procedures employed to prevent the use of unacceptable supplies. Identify the person(s) responsible for checking supplies and implementing corrective actions. If this information is contained in an SOP, then cite the SOP reference. Alternatively, the required information may be presented in a table similar to OPTIONAL QAPP Worksheet #19.

B.2.2 Fixed Laboratory Analytical Method Requirements

This section of the QAPP describes the analytical techniques that will be used by the fixed laboratory to generate screening as well as definitive data for a project. It documents the fixed laboratory analytical methods and SOPs that will be used to meet measurement performance criteria and achieve project-required quantitation limits for the contaminants of concern and other target compounds at the concentration levels and in the specific media/matrices as identified in Section A.6.1. Note the difference between methods and analytical SOPs: methods describe preparatory and analytical/determinative techniques used in target analyte identification and quantitation, while analytical SOPs document how a particular laboratory will perform a specific analytical method.

B.2.2.1 Fixed Laboratory Analytical Methods and SOPs

Fixed Laboratory Analytical Methods and SOPs – All fixed laboratory analytical methods and procedures that will be used in the project must be included in the QAPP to allow for review and approval. While it may be possible to describe simple fixed laboratory analytical procedures within the text of the QAPP, the most efficient and cost-effective way to document project-specific measurement procedures is to include analytical methods and SOPs as attachments to the QAPP. Include methods/SOPs for each analytical parameter, medium/matrix, and concentration level that will be investigated. All methods/SOPs must contain the maximum allowable holding time from sample collection to sample preparation and/or analysis (as appropriate).

If the analytical procedures are documented in the fixed laboratory's QA plan or manual, then it may be easiest to include the relevant sections in the project QAPP or reference the appropriate sections of those documents in the project QAPP. This would preclude including separate analytical SOPs (assuming that those relevant sections of the fixed laboratory's QA plan/manual contain all of the required information). Laboratory QA plans or manuals must be included for each laboratory retained to provide analytical services.

Analytical methods should be written and formatted in accordance with the EMMC guidance provided in Appendix 5. Analytical methods must specify appropriate QC checks and samples with explicit concentration and frequency requirements for preparation and analysis, QC acceptance limits, and required corrective actions for each step of the method.

Analytical SOPs should be written and formatted in accordance with *Guidance for the Preparation of Standard Operating Procedures (SOPs) for Quality-Related Documents*, November 1995, EPA/600/R-96/027 (EPA QA/G-6). In addition to a detailed step-by-step description of the analytical procedure, all SOPs must specify appropriate QC checks and samples with explicit concentration and frequency requirements for preparation and analysis, QC acceptance limits, and required corrective actions for each step of the method.

Include analytical methods and SOPs for any planned contingency analytical work that may be required.

Provide a detailed description, explanation, and SOP for the use of all new and/or innovative analytical techniques that will be employed during the project. Provide documentation of the procedures as well as method performance data and criteria to support the use of new/innovative techniques.

Examples of fixed laboratory methods and SOPs include, but are not limited to:

- EPA Standard Methods
- Fixed Laboratory Analytical SOPs
- Sample Receipt and Storage SOPs
- Sample Tracking SOPs
- Sample Preparation SOPs
- Glassware Cleaning SOPs
- Calibration SOPs
- Maintenance, Testing, and Inspection Activities SOPs
- Analytical Standards Preparation and Traceability SOPs
- Data Reduction Procedures
- Documentation Policies/Procedures
- Data Verification Procedures
- Data Management Procedures
- Sample and Sample Extract/Digestate Disposal SOPs

Fixed Laboratory Analytical Method/SOP Reference Table – Provide a Fixed Laboratory Analytical Method/SOP Reference Table that contains the information shown in OPTIONAL QAPP Worksheet #20. An example of a completed Fixed Laboratory Analytical Method/SOP Reference Table is provided in Figure 20.

Figure 20. Example: Fixed Laboratory Analytical Method/SOP Reference Table

Figure 20. Example: Fixed Laboratory Analytical Method/SOP Reference Table

Reference Number	Fixed Laboratory Performing Analysis	Title, Revision Date and/or Number	Definitive or Screening Data	Analytical Parameter	Instrument	Modified for Project Work Y or N
L-1	*Austin Laboratories*	*Method 524.2 Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry, Rev. 4.1, 1995*	*Definitive*	*VOA*	*GC/MS*	*Y -MS/MSD QC sample added -See QAPP text for complete description of method and modifications.*
L-2	*Austin Laboratories*	*Glassware Cleaning for Volatile Organic Analyses, Rev. 3, 1996*	*NA*	*VOA*	*GC/MS*	*N*
L-3	*Austin Laboratories*	*Standards Preparation and Traceability for Volatile Organic Analyses, Rev. 1, 1995*	*NA*	*VOA*	*GC/MS*	*N*
L-4	*Austin Laboratories*	*Sample Receipt, Custody, and Storage, Rev. 3, 1995*	*NA*	*VOA*	*GC/MS*	*N*
L-5	*Austin Laboratories*	*Preventative Maintenance and Corrective Action Procedures for Gas Chromatographs and Gas Chromatograph/Mass Spectrometers, Rev. 2, 1995*	*NA*	*VOA*	*GC/MS*	*N*
L-6	*Austin Laboratories*	*Hazardous Waste Determination and Disposal Procedures, Rev.1, 1996*	*NA*	*VOA*	*GC/MS*	*N*
L-7	*Austin Laboratories*	*Final Report Preparation for Organic Analyses, Rev. 5, 1996*	*Definitive*	*VOA*	*GC/MS*	*N*

B.2.2.2 Fixed Laboratory Analytical Method/SOP Modifications

If standard EPA methods or other published methods and/or SOPs are modified to meet project quality objectives, then describe those modification(s) in this section. For example, the EPA CLP Low/Medium Concentration VOA Method in the Statement of Work for Organic Analysis OLM03.2 specifies a target compound list of 33 volatile organic compounds. The project planning team may choose to add an additional compound (e.g., dioxane) to the target compound list because it is a contaminant of concern at the site. This would constitute a modification to the standard EPA method.

B.2.2.3 Fixed Laboratory Instrument Calibration

To ensure that the analytical methods and the selected instrumentation meet the project requirements for selective, sensitive, accurate, and precise detection and quantitation of the analytes of interest, it is necessary to completely describe the calibration procedures for each fixed laboratory analytical instrument. This section of the QAPP demonstrates the ability of the fixed laboratory analytical technique to accurately and precisely identify and quantitate the contaminants of concern and other target compounds at the required quantitation limits and within the required measurement ranges.

Fixed Laboratory Instrument Maintenance and Calibration Table – Provide a Fixed Laboratory Instrument Maintenance and Calibration Table that lists all fixed laboratory analytical instrumentation and contains the information shown in OPTIONAL QAPP Worksheet #21. An example of a completed Fixed Laboratory Instrument Maintenance and Calibration Table is provided in Figure 21.

Figure 21. Example: Fixed Laboratory Instrument Maintenance and Calibration Table

Figure 21. Example: Fixed Laboratory Instrument Maintenance and Calibration Table

Instrument	Activity	List Maintenance, Testing, and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference*
GC/MS	*VOA Analysis*	*Check connections, replace disposables, bake out instrument, recondition trap and column, and perform leak tests.*	*IC-instrument receipt, major instrument change, when CC does not meet criteria*	*Min. RRF: 0.05 for most VOCs except Ketones, THF, etc. See Method L-1 for complete list of minimum RRFs Max. RSD: ±25% for all target compounds*	*See method*	*Lucy Alcott*	*L-1*
			CC-at beginning of each 12 hr shift, daily before use	*Min. RRF: 0.05 for most VOCs except Ketones, THF, etc. See Method L-1 for complete list of minimum RRFs Max. %D: ±30% for all target compounds*	*See method*		

*** Specify appropriate reference letter/number from Fixed Laboratory Analytical Method/SOP Reference Table (see OPTIONAL QAPP Worksheet #20).**

Calibration procedures may be documented separately in this section of the QAPP or included in the appropriate fixed laboratory analytical SOPs as attachments to the QAPP. In either case, the items listed in Section B.2.1.3 must be addressed for each analytical procedure.

B.2.2.4 Fixed Laboratory Instrument/Equipment Maintenance, Testing, and Inspection Requirements

This section of the QAPP describes the procedures and documentation activities that will be performed to ensure that all fixed laboratory instrumentation and equipment are available and in working order when needed.

Equipment maintenance logs must be kept and equipment must be checked prior to use. Describe the records that will be kept to document fixed laboratory instrumentation maintenance, testing, and inspection activities.

Discuss the availability of spare parts or spare instruments to ensure that project schedules are met. Discuss how instruments are controlled, instrument security, and log-in/log-out procedures to ensure instrument availability.

List all instrument maintenance, testing, and inspection activities. OPTIONAL QAPP Worksheet #21 may be used for this.

B.2.2.5 Fixed Laboratory Inspection and Acceptance Requirements for Supplies

This section of the QAPP documents the procedures and activities that will be performed to ensure that all supplies used in fixed laboratory work will be available when needed and will be free of contaminants of concern, other target compounds, and interferences.

Itemize the supplies that will be used when performing fixed laboratory work. Identify all vendors for supplies and reagents.

Describe the procedures that will be used to ensure supply cleanliness and reagent purity. Discuss procedures for recording reagent lot numbers and procedures for measuring supply cleanliness. Document corrective action procedures employed to prevent the use of unacceptable supplies. Identify the person(s) responsible for checking supplies and implementing corrective actions. If this information is contained in an SOP, cite the SOP reference. Alternatively, the required information may be presented in a table.

B.3 Quality Control Tasks

B.3.1 Quality Control Requirements

Quality control (QC) is the set of activities that are performed for the purposes of monitoring, measuring, and controlling the performance of a measurement process. QC activities are designed to measure the data quality indicators that are used to evaluate the different components of the measurement system, including sampling and analysis. Without sufficient and appropriate QC activities, an evaluation of planned projects may not be possible. In addition, without adequate planning, project-required activities may not be performed properly or may not be performed at required frequencies. It is necessary that a properly prepared QAPP explicitly detail what field and laboratory activities are to be conducted to meet project quality goals. It is equally important that all project personnel know and understand these activities.

Tables 3 and 4 (Section B.3.1.2) note some of the most common QC activities that are to be incorporated into data collection activities. Those activities that commonly originate in the field are listed in Table 3. Table 4 contains activities that are usually initiated in the laboratory setting. These activities are also somewhat complementary to each other. For example, a single field blank successfully carried through an analytical process can show that the analytical process is free of significant contamination. For many purposes this may be adequate. However, if this single field blank were to show significant contamination, it would not be possible to ascertain the source of the contamination (i.e., whether it occurred in the field or the lab). Knowing the source would be invaluable in troubleshooting and correcting the cause. Because of these concerns, a typical project may include several different types of blanks, all originating at a different stage of the analytical scheme.

Although Tables 3 and 4 contain the most frequently run QC checks, not all checks are applicable to a given analytical procedure. For example, there has never been a good way to perform a spiked analysis for parameters like BOD. Likewise, physical or microbiological testing will often require different types of QC checks than chemical testing. Radiochemical testing will require different procedures than GC/MS for volatile organics. For these reasons, it is not possible to create a list of mandatory QC practices that will apply to all cases. Deciding the most appropriate QC checks is a key part of project planning and frequently requires some professional judgment. Many analytical methods (but not all) will also have very specific QC practices written into the method itself, which must also be followed.

The QAPP must clearly note which project personnel are expected to perform the activities. In addition, the QAPP must contain the following:

- An explicit description of the QC practice to be performed

- A required frequency at which it must be performed
- A description, usually in mathematical terms, of what constitutes acceptable performance for the QC check
- Indicated corrective actions to be taken if the QC check fails these criteria
- A description of how the QC data and results are to be documented and reported to the data user

Many times a tabular format is the most efficient way to present this type of information.

The results of QC checks are also a key factor in data validation and assessment. One of the most critical aspects of validation and assessment will be whether project-specific QC goals have been met. Data that meet project goals for quality can be reasonably expected to provide a sound basis for decision-making. On the other hand, failed QC checks often indicate large uncertainty associated with a data set and infer a corresponding large uncertainty in decisions based on such data.

B.3.1.1 Sampling Quality Control

This section of the QAPP identifies the QC procedures, checks, and samples, and their respective acceptance limits, that will be used during the project to monitor the quality of various aspects of the sampling event(s). Required analysis frequency, acceptance limits, and corrective actions are also documented in this section of the QAPP.

Table 2 provides a list of recommended field QC. However, the actual types and frequencies are determined in advance, during planning, based on the project-specific needs.

Field Sampling QC Table – Provide Field Sampling QC Tables that contain the information shown in OPTIONAL QAPP Worksheet #22a. An example of a completed Field Sampling QC Table is provided in Figure 22a.

If method/SOP QC acceptance limits exceed the project-specific measurement performance criteria, then the data obtained may be unusable in making project decisions.

Figure 22a. Example: Field Sampling QC Table

Table 2. Recommended Types of Field QC Samples and Frequency

Field QC	Data Quality Indicators[1]	Recommended Frequency[2]
Chemical		
Equipment Blank (rinsate blank)	Contamination (Accuracy/Bias)	Minimum 5% per parameter/per matrix/per sampling procedure/per sampling team
Bottle Blank (non-VOA)	Contamination (Accuracy/Bias)	Minimum 1 per lot # of bottles
VOA Trip Blank	Contamination (Accuracy/Bias)	Minimum 1 per shipment cooler
Cooler Temperature Blank (VOA only)	Preservation (Accuracy/Bias)	Minimum 1 per shipment cooler
Performance Evaluation Sample (PES)[3]	Accuracy/Bias	Minimum 1 per SDG/per parameter/per matrix/per concentration level
Field Duplicates[4] -Collocated Samples -Duplicate Subsamples	Precision	Minimum 5% per parameter/per matrix/per sampling procedure/per sampling team
Field Splits[5]	Interlaboratory Comparability	As per method and based on DQOs
Biological		
Biological QC Checks (Biological Specimen Samples)	Reproducibility, etc.	As per method and based on DQOs

[1]See Tables 3 and 4 for additional DQI information.

[2]The QAPP should indicate any deviations from recommended frequencies and provide justification.

[3]Performance evaluation samples, also known as double-blind samples, have been arbitrarily included under field QC samples. They primarily measure analytical error, since their composition is unknown to the laboratory and they originate outside of the laboratory.

[4]Field duplicates are two samples taken from and representative of the same population. Field duplicates are carried through all steps of the sampling and analytical procedures in an identical manner and provide overall precision information for the data collection event. Field duplicates can be subdivided into two categories: collocated samples and duplicate subsamples.

-Collocated samples are two samples collected next to each other in the same vertical position. They are the result of two separate sample collections at the same sample location. Collocated samples include ambient air monitoring samples, composite water samples, surface water grab samples, side-by-side sample corers, etc.

-Duplicate subsamples are subsamples of one sample collection at one sampling location. For example, duplicate subsamples are sometimes taken from soil borings or sediment cores.

[5]Split samples are two or more subsamples taken from a field sample and analyzed by different laboratories to assess interlaboratory comparability. Field samples are homogenized to correct for sample inhomogeneity that would adversely affect split sample data comparability prior to splitting. Split samples should be as identical as possible.

Figure 22a. Example: Field Sampling QC Table

Sampling SOP	*S-1*
Medium/Matrix	*GW*
Analytical Parameter	*VOA-524.2*
Concentration Level	*Low*
Analytical Method/SOP Reference	*L-1*
Sampler's Name	*James Keller*
Field Sampling Organization	*Chaucer Engineering*
No. of Sample Locations	*5*

Field QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Equipment Blanks/ Rinsate Blanks	*1*	*No target compounds $ QL QL = 1 ug/L*	*Reclean, retest, resample, and/or qualify data*	*Field Sampler and Data Validator*	*Accuracy/bias-Contamination*	*No target compounds $ QL*
Bottle Blanks	*Previously analyzed Lot # V6285*	*No target compounds $ QL*	*Reclean, retest, resample, and/or qualify data*	*Field Sampler and Data Validator*	*Accuracy/bias-Contamination*	*No target compounds $ QL*
VOA Trip Blanks	*1 per cooler*	*No target compounds $ QL*	*Reclean, retest, resample, and/or qualify data*	*Field Sampler and Data Validator*	*Accuracy/bias-Contamination*	*No target compounds $ QL*
Cooler Temperature Blanks	*1 per cooler*	*4EC, ±2EC*	*Resample and/or qualify data*	*Field Sampler and Data Validator*	*Accuracy/bias-preservation*	*4EC, ±2EC*
Field Duplicate Pairs	*1*	*See Worksheet #22b*	*Assess laboratory precision and resample and/or qualify data*	*Field Sampler and Data Validator*	*Precision*	*RPD # 30% when VOC detects for both field duplicates are $ QL RPD # 40% when gaseous VOC detects for both field duplicates are $ QL*
Collocated Samples	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
Field Splits	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*	*Not applicable*
PES sent to Laboratory	*1*	*No false negatives, no false positives, all target compounds within quantitative warning limits*	*Qualify data and direct laboratory to investigate problem*	*Data Validator and Laboratory QA/QC Manager*	*Accuracy/bias*	*No false negatives, no false positives, all target compounds within quantitative warning limits*
Other:_____						

Field Sampling SOP Precision and Accuracy Table – If analytical parameters have multiple analytes, provide a Field Sampling SOP Precision and Accuracy Table that contains the information shown in OPTIONAL QAPP Worksheet #22b. List the field precision and accuracy/bias (in terms of contamination) expected for each analyte when using the specified sampling (and analytical) technique. An example of a completed Field Sampling SOP Precision and Accuracy Table is provided in Figure 22b.

Figure 22b. Example: Field Sampling SOP Precision and Accuracy Table

Sampling SOP: *SS-1a/SS-2a (soil samples-surface-subsurface)*
Analytical Method/SOP: *EEV-3/EEV-2*

Figure 22b. Example: Field Sampling SOP Precision and Accuracy Table

Analyte	Field Precision	Field Accuracy/Bias (Contamination)
Acetone	*RPD ≤ 50% for results >Quantitation Limit, RPD ≤ 75% for results between MDL and QL*	*Compound is not detected above Quantitation Limit*
Acetonitrile		
Acrolein		
Acronitrile		
Allyl Alcohol		
Allyl Chloride		
Benzene		
Benzyl Chloride		
bis(2-Chloroethyl)sulfide		
Bromoacetone		
Bromochloromethane		
Bromodichloromethane		
Bromoform		
Bromomethane		
Bromomethane		
n-Butanol		
2-Butanone		
t-Butyl Alcohol		
Carbon Disulfide		

B.3.1.2 Analytical Quality Control

This section of the QAPP identifies the QC procedures, checks, and samples, and their respective acceptance limits, that will be used during the project to monitor the quality of various preparatory and analytical steps. Many methods generally provide QC acceptance limits for most of the QC checks and samples required by those methods. Certain methods require that laboratories generate their own specific QC acceptance limits for some of the QC checks and samples required by those methods. These method- and laboratory-specific limits, however, may not be "tight" enough to support the project quality objectives. In other words, QC sample or check results may meet method/SOP QC acceptance limits but fail to meet the project measurement performance criteria as defined and documented in Section A.7.2. Therefore, it is important to select methods having QC acceptance limits that support the collection of usable project data. Subsequently, it is critical to choose a laboratory that is capable of meeting the project-required QC acceptance limits. Again, method- and laboratory-specific QC acceptance limits, project measurement performance criteria, and project validation criteria must be complementary for project objectives to be achieved.

For some projects, the selected method may not have sufficient QC checks and samples built into the method. In these cases, the Project Team will need to specify what additional QC checks and samples must be analyzed by the laboratory. The laboratory should document additional project-required QC in its analytical SOPs, along with the required frequency acceptance criteria and corrective actions for those QC checks and samples.

Table 3 lists types of field analytical and fixed laboratory QC checks, samples, and procedures.

Different types of QC checks and samples provide data that can be used to isolate different sources of error throughout the measurement system, including contamination, poor precision, poor accuracy/bias, and poor sensitivity. Table 4 summarizes the information derived from different sampling, transportation, and laboratory QC checks and samples. Note that this list does not include all possible QC checks and samples that are available to the user. Also note that analytical methods may define the purpose of specific QC samples differently (e.g., dioxin methodologies), and therefore it is necessary to adhere to the QC definitions of the specific methods employed.

Table 3. Types of Field Analytical and Fixed Laboratory QC Checks/Samples and Recommended Frequency

Analytical QC	Data Quality Indicators[1]	Recommended Frequency[2]
Chemical		
Method Blank	Accuracy/Bias (Contamination)	Minimum 1 per SDG/per parameter/per matrix/per concentration level
Reagent Blank	Accuracy/Bias (Contamination)	As per method and based on DQOs
Storage Blank	Accuracy/Bias (Contamination)	Minimum 1 per aqueous VOA SDG
Instrument (System) Blank	Accuracy/Bias (Contamination)	As per method and based on DQOs
Laboratory Duplicates	Precision	Minimum 1 per inorganic SDG/per parameter/per matrix/per concentration level
Internal Standards	Precision and Accuracy/Bias	As per method and based on DQOs
Analytical Replicates	Precision	As per method and based on DQOs
Matrix Spike Duplicates	Precision and Bias	Minimum 1 set per Organic SDG/per parameter/per matrix/per concentration level
Matrix Spike	Bias	Minimum 1 per Inorganic SDG/per parameter/per matrix/per concentration level
PES –Single Blind and Double Blind	Bias	Minimum 1 per SDG/per parameter/per matrix/per concentration level
Surrogate Spikes	Bias	As per method and based on DQOs
Laboratory Control Sample (LCS) – Zero Blind PES	Bias	As per method and based on DQOs
Laboratory Fortified Blank (LFB)[3] – Zero Blind PES	Bias and Sensitivity	Minimum 1 per Aqueous Low Concentration Organic SDG/analytical parameter As per method and based on DQOs for other parameters, matrices, and concentration levels
Method Detection Limit Studies (MDL)	Sensitivity	Annually per laboratory/per parameter/per matrix/per concentration level
Instrument Performance Check Samples	Sensitivity	As per method and based on DQOs
Initial Calibration	Accuracy	After initial instrument setup, as per method and when calibration verification fails
Continuing Calibration and/or Calibration Verification Checks	Accuracy	Minimum 1 per analytical shift and more frequently as per method and based on DQOs
Biological		
Biological QC Checks (Biological Specimen Samples)	Reproducibility, etc.	As per method and based on DQOs

[1]See Table 4 for additional DQI information.
[2]The QAPP should indicate any deviations from recommended frequencies and provide justification.
[3]An LFB is defined as an aliquot of reagent matrix spiked with several or all of the target compounds/analytes at or below their quantitation limits.

Table 4. Information Derived from Quality Control Checks and Samples

Data Quality Indicator (Type of Information Provided)	QC Checks and Samples	Sources of Measurement Error										
		Sample Collection				Sample Transport	Laboratory					
		Sampling Equipment	Sample Container	Preservation Technique	Sample Matrix	Shipment Process	Sample Storage @ Laboratory	Sample Preparation Reagents	Sample Preparation Equipment	Analytical Method Reagents	Analytical Equipment	Purpose
Accuracy/Bias (contamination)	Equipment Blank (Rinsate blank)	X	X	X		X	X	X	X	X	X	To evaluate carryover contamination resulting from successive use of sampling equipment.
	Bottle Blank per Lot #		X					X	X	X	X	To evaluate contamination introduced from the sample container.
	VOA Trip Blank		X	X		X	X	X	X	X	X	To evaluate contamination introduced during shipment.
	Storage Blank						X	X	X	X	X	To evaluate cross-contamination introduced during sample storage.
	Method Blank							X	X	X	X	To evaluate contamination introduced during sample preparation and/or analysis by laboratory, including reagents, equipment, sample handling, and ambient laboratory conditions.
	Reagent Blank per Lot #							X	X	X	X	To evaluate contamination introduced by specific method reagents.
	Instrument (system) Blank									X	X	To evaluate contamination originating from the analytical reagents instrumentation.
Accuracy/Bias (preservation)	Cooler Temp. Blank – VOA only			X								To evaluate whether or not samples were adequately cooled during shipment.

Table 4. Information Derived from Quality Control Checks and Samples (continued)

Data Quality Indicator (Type of Information Provided)	QC Checks and Samples	Sources of Measurement Error										
		Sample Collection				Sample Transport	Laboratory					
		Sampling Equipment	Sample Container	Preservation Technique	Sample Matrix	Shipment Process	Sample Storage @ Laboratory	Sample Preparation Reagents	Sample Preparation Equipment	Analytical Method Reagents	Analytical Equipment	Purpose
Accuracy/Bias	**Matrix Spike**				X			X	X	X	X	To determine laboratory preparatory and analytical bias for specific compounds in specific sample matrices.
	Surrogate Spike				X			X	X	X	X	To evaluate laboratory preparatory and analytical bias for specific sample matrices.
	Laboratory Control Sample (LCS) -- Zero Blind							X	X	X	X	To evaluate the laboratory's ability to accurately identify and quantitate target compounds in a reference matrix at a known concentration, usually midrange of the calibration curve.
	Performance Evaluation Sample – Ampulated Single Blind							X	X	X	X	To evaluate sample handling procedures from field to laboratory. To evaluate the laboratory's ability to accurately identify and quantitate target compounds in a reference matrix. Frequently used for data quality assessments and for laboratory self-assessments and external assessments, i.e., preawards and laboratory TSAs.
	Performance Evaluation Sample – Full Volume Single Blind		X	X		X	X	X	X	X	X	

Table 4. Information Derived from Quality Control Checks and Samples (continued)

Data Quality Indicator (Type of Information Provided)	QC Checks and Samples	Sources of Measurement Error											
		Sample Collection				Sample Transport	Laboratory						
		Sampling Equipment	Sample Container	Preservation Technique	Sample Matrix	Shipment Process	Sample Storage @ Laboratory	Sample Preparation Reagents	Sample Preparation Equipment	Analytical Method Reagents	Analytical Equipment	Purpose
Accuracy/Bias (continued)	Performance Evaluation Sample – Double Blind		X	X		X	X	X	X	X	X	To evaluate sample handling procedures from field to laboratory. To evaluate the laboratory's ability to accurately identify and quantitate target compounds in a reference matrix.
	Laboratory Fortified Blank (LFB)							X	X	X	X	A type of LCS used to evaluate laboratory (preparatory and analytical) sensitivity and bias for specific compounds in a reference matrix at the quantitation limit concentrations.
	Initial Calibration									X	X	To ensure that the instrument is capable of producing acceptable qualitative and quantitative data.
	Continuing Calibration/ Continuing Calibration Verification									X	X	To ensure the accuracy and stability of the instrument response.
	Instrument Performance Check Sample									X	X	To verify that an instrument can accurately identify and quantitate target analytes at specific concentration levels.

Table 4. Information Derived from Quality Control Checks and Samples (continued)

Data Quality Indicator (Type of Information Provided)	QC Checks and Samples	Sources of Measurement Error										
		Sample Collection				Sample Transport	Laboratory					
		Sampling Equipment	Sample Container	Preservation Technique	Sample Matrix	Shipment Process	Sample Storage @ Laboratory	Sample Preparation Reagents	Sample Preparation Equipment	Analytical Method Reagents	Analytical Equipment	Purpose
Sensitivity	**LFB**							X	X	X	X	A type of LCS used to evaluate laboratory (preparatory and analytical) sensitivity and bias for specific compounds in a reference matrix at the quantitation limit concentrations.
	MDL Studies				X (if performed using same reference matrix)			X	X	X	X	A statistical determination that defines the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Quantitation limits (QLs)/practical QLs (PQLs) are generally 3-10 times the MDL.
	Low Point of Initial Calibration Curve									X	X	To ensure that the instrument is capable of producing acceptable qualitative and quantitative data at the lowest concentration that sample results will be reported; the quantitation limit.

Table 4. Information Derived from Quality Control Checks and Samples (continued)

Data Quality Indicator (Type of Information Provided)	QC Checks and QC Samples	Sources of Measurement Error										
		Sample Collection				Sample Transport	Laboratory					
		Sampling Equipment	Sample Container	Preservation Technique	Sample Matrix	Shipment Process	Sample Storage @ Laboratory	Sample Preparation Reagents	Sample Preparation Equipment	Analytical Method Reagents	Analytical Equipment	Purpose
Precision	**Field Duplicates**	X	X	X	X	X	X	X	X	X	X	To measure overall precision by evaluating cumulative effects of both field and laboratory precision.
	Laboratory Duplicates				X			X	X	X	X	To evaluate laboratory preparatory and analytical precision.
	Matrix Spike Duplicates				X			X	X	X	X	To determine laboratory preparatory and analytical bias and precision for specific compounds in specific sample matrices.
	Analytical Replicates (e.g., duplicate injections)										X	To evaluate analytical precision for determinative instrumentation.
	Internal Standards										X	To evaluate biological instrument precision and stability.
Interlaboratory Comparability	**Field Splits**					X	X	X	X	X	X	To evaluate sample handling procedures from field to laboratory and to evaluate interlaboratory comparability and precision.
Reproducibility	**Biological QC Check**	X	X	X		X	X	X	X	X	X	To evaluate biological sorting reproducibility between laboratories and/or analysts.

B.3.1.2.1 ***Field Analytical QC***

Field Analytical QC Sample Table – Provide Field Analytical QC Sample Tables that contain the information shown in OPTIONAL QAPP Worksheet #23a. An example of a completed Field Analytical QC Sample Table is provided in Figure 23a.

If method/SOP QC acceptance limits exceed the project-specific measurement performance criteria, then the data obtained may be unusable in making project decisions.

Figure 23a. Example: Field Analytical QC Sample Table

Figure 23a. Example: Field Analytical QC Sample Table

Medium/Matrix	*Soil*
Sampling SOP	*S-1*
Analytical Parameter	*PCBs-Screening*
Concentration Level	*Medium*
Analytical Method/ SOP Reference	*F-11*
Field Analytical Organization	*STARP*
No. of Sample Locations	*20*

Laboratory QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	*1 per extr. batch and daily after calibration*	*No Aroclors $ 1 ppm QL*	*Reclean, reextract and reanalyze*	*Analyst and Data Verifier*	*Accuracy/bias Contamination*	*No Aroclors $ 1 ppm QL*
Reagent Blank	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Storage Blank	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Instrument Blank	*1 every 10 samples and as needed to assess carryover from high concentration samples*	*No Aroclors $ 1 ppm QL*	*Continue analyzing instrument blanks until acceptable*	*Analyst and Data Verifier*	*Accuracy/bias Contamination*	*No Aroclors $ 1 ppm QL*
Laboratory Duplicate	*1 per 20 samples*	*See Worksheet #23b*	*Reanalyze and qualify data*	*Analyst and Data Verifier*	*Analytical precision*	*RPD # 50%*
Laboratory Matrix Spike	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Matrix Spike Duplicates	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
LCS	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
LFB @ QL	*1 per extr. batch and daily after method blk*	*60-140%*	*Reextract and reanalyze. Do not proceed with sample analysis until acceptable PES is obtained.*	*Analyst and Data Verifier*	*Accuracy/bias*	*±40% @ QL*
Surrogates	*2 per sample*	*40-60%; RTs within 30 sec of CCAL*	*Reanalyze and quantify data*	*Analyst and Data Verifier*	*Accuracy/bias*	*±40% @ QL*
Internal Standards (ISs)	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Other: *Performance Evaluation Sample*	*Daily*	*No false negatives, no false positives, all Aroclors within quantitative warning limits*	*Reextract, reanalyze. Qualify all field data associated with unacceptable PES.*	*Analyst and Data Verifier*	*Accuracy/bias*	*No false negatives, no false positives, all Aroclors within quantitative warning limits*

If analytical parameters have multiple analytes, provide a Field Analytical Method/SOP Precision and Accuracy Table that contains the information shown in OPTIONAL QAPP Worksheet #23b. An example of a completed Field Analytical Method/SOP Precision and Accuracy Table is provided in Figure 23b.

Figure 23b. Example: Field Analytical Method/SOP Precision and Accuracy Table

Sampling SOP: *S-1*
Analytical Method/SOP: *F-11*

Figure 23b. Example: Field Analytical Method/SOP Precision and Accuracy Table

Analyte	Achievable Sensitivity/Quantitation Limits	Field Analytical Precision	Field Analytical Accuracy/Bias
Aroclor 1242	*1 Fg/g (dry weight)*	*RPD # 50%*	*40-160%*
Aroclor 1254	*1 Fg/g (dry weight)*	*RPD # 50%*	*40-160%*
Aroclor 1260	*1 Fg/g (dry weight)*	*RPD # 50%*	*40-160%*

Field Screening/Confirmatory Analysis Decision Tree – If field screening techniques are used, provide a decision tree or logic diagram to describe how samples will be selected for subsequent confirmatory analysis.

B.3.1.2.2 ***Fixed Laboratory QC***

Fixed Laboratory Analytical QC Sample Table – Provide Fixed Laboratory Analytical QC Sample Tables that contain the information shown in OPTIONAL QAPP Worksheet #24a. An example of a completed Fixed Laboratory Analytical QC Sample Table is provided in Figure 24a.

If method/SOP QC acceptance limits exceed the project-specific measurement performance criteria, then the data obtained may be unusable in making project decisions.

Figure 24a. Example: Fixed Laboratory Analytical QC Sample Table

Figure 24a. Example: Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	*GW*
Sampling SOP	*S-1*
Analytical Parameter	*VOA-524.2*
Concentration Level	*Low*
Analytical Method/ SOP Reference	*L-1*
Laboratory Name	*Austin Laboratories*
No. of Sample Locations	*5*

Laboratory QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank	*1 per 12 hr shift*	*No target compounds $ QL*	*Reclean, retest, & reanalyze*	*Analyst & Data Validator*	*Accuracy/bias-Contamination*	*No target compounds $ QL*
Reagent Blank	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Storage Blank	*1 per SDG*	*No target compounds $ QL*	*Reclean, retest, & reanalyze*	*Analyst & Data Validator*	*Accuracy/bias-Contamination*	*No target compounds $ QL*
Instrument Blank	*As needed-to assess carryover from high conc. samples*	*No target compounds $ QL*	*Reclean, retest, & reanalyze*	*Analyst & Data Validator*	*Accuracy/bias-Contamination*	*No target compounds $ QL*
Laboratory Duplicate	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Laboratory Matrix Spike	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Matrix Spike Duplicates	*1 per SDG*	*See Worksheet #24b*	*Reanalyze and qualify data*	*Analyst & Data Validator*	*Accuracy/bias & Precision*	*Accuracy/bias-±20% except for VOC gases ±40% Precision, RPD#20%*
LCS	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
LFB	*1 per day prior to sample analysis*	*±40% @ QL*	*Do not proceed with analysis until acceptable LFB obtained*	*Analyst & Data Validator*	*Sensitivity*	*±40% @ QL*
Surrogates	*2 per sample*	*80-120%; RRTs within 30 sec. of CC*	*Reanalyze and qualify data*	*Analyst & Data Validator*	*Accuracy/bias*	--
Internal Standards (ISs)	*2 per sample*	*Area counts within range of -50.0% and +100% of IC IS Area; RTs within 30 sec. of CC*	*Reanalyze and qualify data*	*Analyst & Data Validator*	*Accuracy/bias & Precision*	--
Other: _____						

If analytical parameters have multiple analytes, provide a Fixed Laboratory Method/SOP Precision and Accuracy Table that contains the information shown in OPTIONAL QAPP Worksheet #24b. An example of a completed Fixed Laboratory Method/SOP Precision and Accuracy Table is provided in Figure 24b.

Figure 24b. Example: Fixed Laboratory Method/SOP Precision and Accuracy Table

Sampling SOP: S-1
Analytical Method/SOP: *L-1; VOA - 524.2*

Figure 24b. Example: Fixed Laboratory Method/SOP Precision and Accuracy Table

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits	Analytical Precision	Analytical Accuracy/Bias
**Vinyl Chloride*	*1 Fg/L*	*RPD # 30%*	*60-140%*
**Benzene*		*RPD # 20%*	*80-120%*
**Trichloroethene*		*RPD # 20%*	*80-120%*
1,2-Dichloroethane		*RPD # 20%*	*80-120%*
Carbon Tetrachloride			
1,2-Dichloropropane			
1,1,2-Trichloroethane			
cis-1,3-Dichloropropene			
Bromoform			
Tetrachloroethene			
1,2-Dibromoethane			
1,4-Dichlorobenzene			
Bromobenzene			
Bromochloromethane			
Bromodichloromethane		—	—
Bromomethane	—	*RPD # 30%*	*60-140%*

B.4 Data Acquisition Tasks

B.4.1 Data Acquisition Requirements (Non-Direct Measurements)

This section of the QAPP identifies the sources of previously collected data and other information that will be used to make project decisions. It is essential to identify the limitations on the use of acquired data, since using data and information that are not generated under the same quality objectives as the current investigation may result in erroneous decisions. Diagram 5 outlines the process used to evaluate acquired data.

The term "acquired data" is defined as information from any source outside of the current activity that may affect the environmental decision-making process. Secondary sources of acquired data and information include, but are not limited to:

- Historical data (e.g., from an organization's or facility's corporate records and/or Federal, State, or local records pertaining to previous monitoring events, site assessments, investigations, etc.). Historical data may be used in QAPP Section A.5.2 to describe the site history and define the environmental problem.
- Background information/data from an organization's/facility's corporate records and/or Federal, State, or local records pertaining to site-specific industrial processes, process by-products, past and current chemical uses, raw material and finished product testing, waste testing and disposal practices, and potential chemical breakdown products.
- Data generated to verify innovative technologies and methods.
- Data generated from computer databases (such as manufacturers' process/product information or waste management or effluent information).
- Environmental indicator data obtained from Federal, State, or local records.
- Computer models or algorithms.
- Literature files/searches.
- Publications.
- Photographs.
- Topographical maps.

Note that the quality of acquired data will become an increasingly important issue for many EPA programs. To ensure that correct environmental decisions are made, the same care should be taken using secondary data as is taken in generating new data.

Non-Direct Measurements Criteria and Limitations Table – Present a table that includes all non-direct measurement data/information that will be used for this project, and their originating sources, shown in OPTIONAL QAPP Worksheet #25. Specify how those acquired data/information will be used and the limitations on their use. Note: Since this table does not capture all required information

regarding acquired data, it is necessary to provide additional information in the text. An example of a completed Non-Direct Measurements Criteria and Limitations Table is provided in Figure 25.

Figure 25. Example: Non-Direct Measurements Criteria and Limitations Table

Diagram 5. Acquired Data Evaluation Process

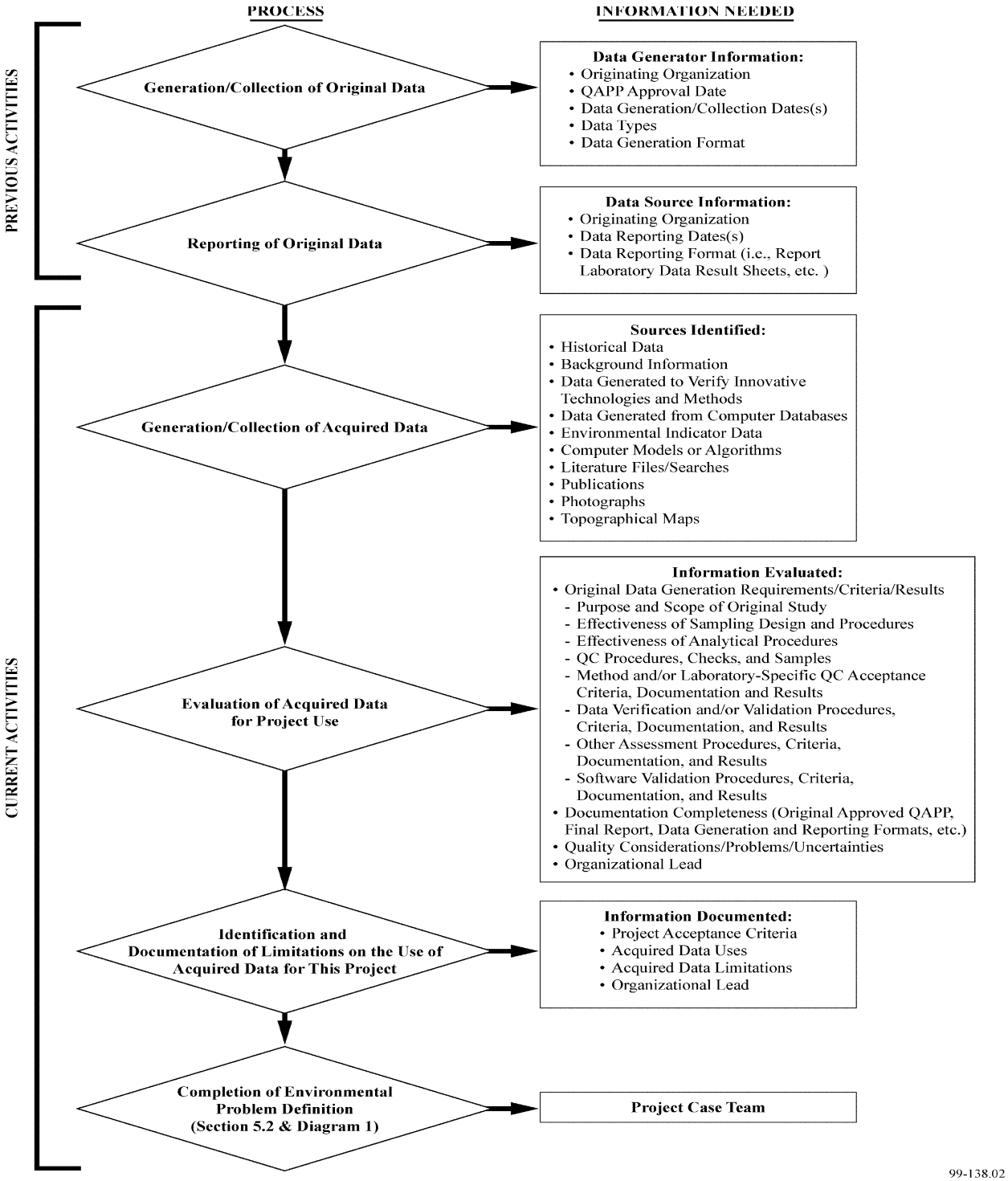


Figure 25. Example: Non-Direct Measurements Criteria and Limitations Table

Non-Direct Measurement (Secondary Data)	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Soil Gas Data	*BioWatch Consulting, LTD: "Titanic Shipyard Investigation Report," 11/20/95*	*BioWatch Consulting, LTD: VOC Soil Gas Data, Sample Collection Dates: 10/19-23/95*	*To assess the potential sources of contaminated soil and resultant groundwater migration*	*1. Unvalidated data used to generate report 2. Insufficient data points to fully characterize on-site contamination and off-site migration*
Municipality Drinking Water Data	*XYZ Municipality: Quarterly Drinking Water Check Report, 6/95 - 6/96*	*Smith Laboratories, Inc.: VOC Drinking Water Data, Sample Collection Dates: 6/12/95, 9/15/95, 12/10/95, 3/6/96, 6/12/96*	*To assess existing groundwater contamination*	*1. Unvalidated data used to generate report 2. Limited number of wells exist to sample*

Evaluate and discuss the quality of all non-direct measurement data as well as the completeness of the data documentation. Identify the generator(s) of the data, dates the data were generated/collected and reported, source(s) from which the data were obtained, and procedures originally used to generate and collect the data (including sampling, analytical, and assessment procedures). If known, describe all QC procedures, checks, and samples that were analyzed with the data set. Describe the method and/or laboratory-specific QC acceptance criteria used for data generation and ascertain whether or not data were verified and/or validated. If data were verified/validated, describe the criteria and procedures used, the documentation provided, as well as the results obtained from previous verification/validation activities. Refer to Section D.1 for a complete discussion of data verification/validation.

In the text, discuss the quality of the previously generated data, addressing the following issues:

- If the data were generated under an approved QAPP or other sampling document, reference the document by title, date, originating organization, and approving organization.
- Evaluate the purpose and scope of previous studies and compare with current study objectives. Evaluate similarities and differences of the measurement performance criteria and data quality indicators.
- Evaluate the design and implementation of previous studies by examining the following issues:
  - Whether the study was conducted properly
  - Whether control responses were within acceptable limits
  - Whether standard sampling and analytical methods and/or standard QA/QC protocols were available and followed by the study.
- Include a brief description of the sampling procedures per matrix type (e.g., grab/grid for surficial soils, etc.) and analytical procedures per matrix type (e.g., SW-846 Method 3550/8270 for surficial soils, etc.).
- If performance and/or system audits and/or split sampling activities were performed, synopsize the results of those audits/activities.
- If data were verified and/or validated, reference the verification and/or validation procedure by title, date, and originating organization.
- If data were obtained from a computer model/algorithm, provide a brief description of the validation of that computer software.
- If data were obtained from a database, provide a brief discussion on the integrity/accuracy of the database information.
- Discuss the adequacy of the original QA documentation under which secondary data were generated. For example, if insufficient raw analytical data are available to verify that an instrument was calibrated accurately, then the secondary data may not be usable for their intended purpose.

Discuss all possible limitations on the use of previously generated/collected non-direct measurement data for this project based on the uncertainty surrounding their quality. Discuss the nature and magnitude of that uncertainty. For example, discuss the impact of using unvalidated historical monitoring data to answer project questions and support project decisions. Unvalidated data may be scientifically inaccurate or may not meet the objectives of the user. Also, discuss the impact of using acquired data with known analytical or sampling inaccuracy or bias and/or imprecision. For example, document the sampling and analytical methods used to collect and analyze soil VOA samples and discuss possible low bias in sample results.

Document the acceptance criteria used to determine whether those previously generated/collected non-direct measurement data/information are usable for this project. For example, if acquired drinking water data will be used to answer project questions, then the QAPP should state that only data generated by EPA/State-certified or NELAP-accredited Safe Drinking Water Act (SDWA) laboratories will be used for this project. Provide comparability criteria for previously generated/collected non-direct measurement data (e.g., historical routine monitoring data) and the data generated for this project.

B.5 Data Management Tasks

B.5.1 Documentation, Records, and Data Management

All project data and information must be documented in a format that is usable by project personnel. This section of the QAPP describes how project data and information will be documented, tracked, and managed from their generation in the field to final use and storage in a manner that ensures data integrity and defensibility.

B.5.1.1 Project Documentation and Records

Project Documents and Records Table – Provide a Project Documents and Records Table that contains the information shown in OPTIONAL QAPP Worksheet #26. Identify the documents and records that will be generated for all aspects of the project, including but not limited to the following:

1. Sample Collection Records
   - Field logbooks/notes
   - Field data collection sheets
   - Chain-of-custody records
   - Custody seals
   - Sample tags
   - Telephone logs
   - Airbills
   - Corrective action reports

2. Field Analysis Records
   - Chain-of-custody records
   - Sample receipt forms/sample tracking forms
   - Preparation and analysis forms and/or logbooks
   - Tabulated data summary forms and raw data for field samples, standards, QC checks, and QC samples
   - Other project-specific documents, such as telephone logs, MDL studies, Initial Precision and Accuracy (IPA) Tests, and corrective action reports

3. Fixed Laboratory Records
   - Chain-of-custody records
   - Sample receipt forms/sample tracking forms
   - Preparation and analysis forms and/or logbooks
   - Tabulated data summary forms and raw data for field samples, standards, QC checks, and QC samples

- Other project-specific documents in the laboratory's possession, such as telephone logs, MDL studies, IPA Tests, Laboratory Pre-award Documentation (including pre-award PE sample data and relevant copies of proposal package), and corrective action reports

4. Project Data Assessment Records
   - Field sampling audit checklists
   - Field analytical audit checklists
   - Fixed laboratory audit checklists
   - PE sample results
   - Data validation reports
   - Telephone logs
   - Corrective action reports

An example of a completed Project Documents and Records Table is provided in Figure 26.

Figure 26. Example: Project Documents and Records Table

Figure 26. Example: Project Documents and Records Table

Sample Collection Records	Field Analysis Records	Fixed Laboratory Records	Data Assessment Records	Other _____
Field Notes	*Sample Receipt, Custody, and Tracking Records*	*Sample Receipt, Custody, and Tracking Records*	*Field Sampling Audit Checklists*	
Chain-of-Custody Records	*Standards Traceability Logs*	*Standard Traceability Logs*	*Field Analysis Audit Checklists*	
Air Bills	*Equipment Calibration Logs*	*Equipment Calibration Logs*	*Fixed Laboratory Audit Checklists*	
Boring Logs	*Sample Prep Logs*	*Sample Prep Logs*	*Data Validation Reports*	
Sample Tags	*Run Logs*	*Run Logs*	*PE Sample Results*	
Custody Seals	*Equipment Maintenance, Testing, and Inspection Logs*	*Equipment Maintenance, Testing, and Inspection Logs*	*Corrective Action Forms*	
Telephone Logs	*Corrective Action Forms*	*Corrective Action Forms*	*Telephone Logs*	
Corrective Action Forms	*Reported Field Sample Results*	*Reported Field Sample Results*		
	Reported Results for Standards, QC Checks, and QC Samples	*Reported Results for Standards, QC Checks, and QC Samples*		
	Instrument Printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples	*Instrument Printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples*		
	Data Verification Checklists	*Data Package Completeness Checklists*		
	Sample Disposal Records	*Sample Disposal Records*		
	Telephone Logs	*Telephone Logs*		

B.5.1.2 Field Analysis Data Package Deliverables

In this section of the QAPP, specify required data package turnaround times for each field analytical parameter. Itemize the required data package deliverables for all field analytical data generated in the field.

Field Analytical-Screening Data — The requirements for field analysis (screening) data packages are project-specific. In addition, the usability of field screening data depends on the project quality objectives and the comparability of those data to the full protocol (on-site mobile laboratory and/or fixed laboratory) confirmatory data. If comparability issues arise during the comparison of field screening and full-protocol data and they cannot be resolved due to the nonexistence and/or unavailability of sufficient documentation for the field screening data, then the achievement of the project objectives may be jeopardized since those field screening data cannot be used to make the planned project decisions.

Field Analytical Date, Definitive Data, and Field Measurement — If field measurements (for example, specific conductance, temperature, DO, pH, turbidity, ORP/Eh, and residual chlorine) are taken, then all field and QC sample results, calibrations, and calibration verifications should be recorded in a field log notebook to ensure proper verification of sample results. If field analytical data are generated for definitive purposes, that is, by full-protocol methods, then a complete data package should be generated to ensure that data can be properly validated (see Tables 5 and 6).

If complete field analysis data packages (i.e., original raw data) are not required deliverables, then the QAPP must justify this decision and specify which project data will be kept by the field analytical unit, where the data will be stored (provide the organization's name and address and identify exact location in building), and how long it will be stored (the length of required record storage is program-dependent).

Even if complete data packages are not required deliverables in the QAPP, all hard-copy and electronic data/information relevant to the project must be archived by the field analytical unit in one location to ensure their availability for potential future retrieval/use.

For all data collection events, in order to facilitate possible future review, it is strongly recommended that raw data, such as magnetic tapes of all field samples, QC checks, and samples, standards, and blanks be archived, if applicable, to the analytical technique, and be available on request for a minimum of 5 years from the date of generation.

B.5.1.3 Fixed Laboratory Data Package Deliverables

Specify required data package turnaround times for each analytical parameter for each fixed laboratory retained to provide analytical services. Itemize the required data package deliverables for all data generated in a fixed laboratory.

For all data collection events, a complete laboratory data package (as itemized in Tables 5 and 6) should be provided for each set of samples designated as a group (sample delivery group, or SDG). A good example of the requirements for a data package for 18 different analytical methods is found in the EPA Region 9 draft report, *Laboratory Documentation Requirements for Data Validation*, July 1997 (9QA-07-97) (available at http://www.epa.gov/region09/qa/r9_qadocs.html).

It is recommended that magnetic tapes of all field samples, QC checks and samples, standards, and blanks be archived, if applicable, to the analytical technique, and be available upon request for 1 year from date of generation.

Complete laboratory data package deliverables often include the following documents, as shown on Tables 5 and 6:

Table 5. Recommended Complete Laboratory Data Package Documentation

COMPLETE LABORATORY DATA PACKAGE DOCUMENTATION

1. Original *sample data package*, including tabulated summary forms and raw data for field samples, standards, QC samples, and blanks (see below, Sample Data Package Documentation)
2. A completed and signed Document Inventory Sheet used to record the inventory of the complete laboratory data package
3. All original shipping documents including, but not limited to, the following documents:
    a. Client chain-of-custody records/traffic reports
    b. Airbills
    c. Custody seals
    d. Sample tags (if present)
4. All original receiving documents including, but not limited to, the following documents:
    a. Sample log-in sheet, used to document the receipt and inspection of samples and containers
    b. Other receiving forms or copies of receiving logbooks
    c. Sample Delivery Group cover sheet identifying the samples received for the group of samples in the data package
5. All original laboratory records of sample transfer, preparation, and analysis, including, but not limited to, the following documents:
    a. Original preparation and analysis forms and/or copies of preparation and analysis logbook pages
    b. Internal sample and sample extract (organics) or sample digestate/distillate (inorganics) transfer chain-of-custody records
6. All other original project-specific documents in the possession of the laboratory including, but not limited to, the following documents:
    a. Telephone contact logs
    b. Copies of personal logbook pages
    c. All handwritten project-specific notes
    d. All other project-specific documents not covered by the above

SAMPLE DATA PACKAGE DOCUMENTATION

1. Narrative
2. Tabulated summary forms for
    - Field sample data (listed by increasing client sample identification number)
    - Laboratory standards (in chronological order by instrument)
    - QC samples (in chronological order by type of QC sample)
    - Blanks (in chronological order by instrument)
3. Raw data for field samples, laboratory standards, QC samples, and blanks (in chronological order by instrument)
4. Laboratory logbook pages for preparation and analysis of field samples, standards, QC samples, and blanks
5. Chain-of-custody records
6. Other project-specific documents in the laboratory's possession

For organic data, each type of tabulated summary form must be grouped by fraction (volatile, semivolatile, pesticide/PCB). Depending on whether the data package contains organic or inorganic analytical data, the required tabulated forms and format for field samples, standards, QC samples, and blanks will vary.

Table 6. Recommended Laboratory Data Package Elements

DATA PACKAGE ELEMENTS	VOA	SVOA	PEST/PCB	METALS	CN	OTHER
● INVENTORY SHEET (Org. and Inorg. DC-2 Form)	X	X	X	X	X	X
● NARRATIVE (Org. Narrative, Inorg. Cover Page)	X	X	X	X	X	X
● EPA SHIPPING/RECEIVING DOCUMENTS AND INTERNAL LABORATORY CHAIN-OF-CUSTODY RECORDS:						
- Airbills	X	X	X	X	X	X
- Chain-of-Custody Records/Forms (Traffic Report)	X	X	X	X	X	X
- Sample Tags	X	X	X	X	X	X
- Sample Log-In Sheet (Org. and Inorg. DC-1 Form)	X	X	X	X	X	X
- Miscellaneous Shipping/Receiving Records	X	X	X	X	X	X
- Internal Lab. Sample Transfer Records and Tracking Sheets	X	X	X	X	X	X
● SAMPLE DATA:						
- Tabulated Summary Form for Field Sample and PE Sample Results (Org. and Inorg. Form I)	X	X	X	X	X	X
- Tentatively Identified Compounds Tabulated Summary Form (Org. Form I TIC)	X	X				
- Reconstructed total ion chromatogram (RIC) for each sample	X	X				
- Raw spectra of target compound and background-subtracted spectrum of target compound for each sample	X	X				
- Mass spectra of all reported TICs/three best library matches for each sample	X	X				
- Chromatograms from both columns for each sample			X			
- GC integration report or data system printouts and calibration plots for each sample			X			
- PEST/PCB Identification Tabulated Summary Form (Org. Form X)			X			
- For PEST/PCBs confirmed by GC/MS, copies of raw spectra and background-subtracted spectrum of target compounds			X			
- GPC sample chromatograms		X	X			
- Manual worksheets	X	X	X	X	X	X
- Sample preparation/extraction/digestion log (Inorg. Form XIII) and logbook pages	X	X	X	X	X	X

VOA = volatile organic compounds
SVOA = semivolatile organic compounds
PEST = pesticide organic compounds
PCB = polychlorinated biphenyls
CN = cyanide
Other = other parameters
( ) = Form Number, refer to CLP SOW forms if CLP is used

Table 6. Recommended Laboratory Data Package Elements (continued)

DATA PACKAGE ELEMENTS	VOA	SVOA	PEST/PCB	METALS	CN	OTHER
● SAMPLE DATA (continued):						
- Sample analysis run log (Inorg. Form XIV) and logbook pages	X	X	X	X	X	X
- ICP raw data				X		
- Furnace AA raw data				X		
- Mercury raw data				X		
- Cyanide raw data					X	
- Other analytical raw data						X
● STANDARDS DATA:						
- Method Detection Limit Study Tabulated Summary Form	X	X	X	X	X	X
- Initial Calibration Tabulated Summary Form (Org. Form VI, Inorg. Form IIA)	X	X	X	X	X	X
- Continuing Calibration Tabulated Summary Form (Org. Form VII, Inorg. Form IIA)	X	X	X	X	X	X
- RICs and quantitation reports for all GC/MS standards	X	X				
- Pesticide Analyte Resolution Tabulated Summary Form (Org. Form VI, Pest-4)			X			
- Pesticides Calibration Verification Tabulated Summary Form (Org. Form VII, Pest-1 and Pest-2)			X			
- Pesticide Analytical Sequence Tabulated Summary Form (Org. Form VIII-Pest)			X			
- GC chromatograms and data system printouts for all GC standards			X			X
- For pesticides/aroclors confirmed by GC/MS, copies of spectra for standards used			X			
- GPC Calibration Tabulated Summary Form (Org. Form IX, Pest-2)			X			
- Florisil Cartridge Check Tabulated Summary Form (Org. Form IX, Pest-1)			X			
- Instrument Detection Limits Tabulated Summary Form (Inorg. Form X)				X	X	
- ICP Interelement Correction Factors Tabulated Summary Form (Inorg. Form XIA and XIB)				X		
- ICP Linear Ranges Tabulated Summary Form (Inorg. Form XII)				X		
- CRDL Standards for AA and ICP Tabulated Summary Form (Inorg. Form IIB)				X		
- Standards preparation logbook pages	X	X	X	X	X	X

VOA = volatile organic compounds
SVOA = semivolatile organic compounds
PEST = pesticide organic compounds
PCB = polychlorinated biphenyls
CN = cyanide
Other = other parameters
( ) = Form Number, refer to CLP SOW forms if CLP is used

Table 6. Recommended Laboratory Data Package Elements (continued)

DATA PACKAGE ELEMENTS	VOA	SVOA	PEST/PCB	METALS	CN	OTHER
● QC DATA:						
- Tuning and Mass Calibration Tabulated Summary Form (Org. Form V)	X	X				
- Surrogate Percent Recovery Tabulated Summary Form (Org. Form II)	X	X	X			
- MS/MSD Recovery Tabulated Summary Form (Org. Form III)	X	X	X			
- Method Blank Tabulated Summary Form (Org. Form IV and Inorg. Form III)	X	X	X	X	X	
- Internal Standard Area and RT Tabulated Summary Form (Org. Form VIII)	X	X				
- QC Raw Data - RICs, chromatograms, quantitation reports, integration reports, mass spectra, etc.	X	X	X			X
- ICP Interference Check Sample Tabulated Summary Form (Inorg. Form IV)				X		
- Spike Sample Recovery Tabulated Summary Form (Inorg. Form VA)				X	X	
- Post Digest Spike Sample Recovery Tabulated Summary Form (Inorg. Form VB)				X	X	
- Duplicates Tabulated Summary Form (Inorg. Form VI)				X	X	
- Internal Laboratory Control Sample Tabulated Summary Form (Inorg. Form VII)				X	X	
- Standard Addition Results Tabulated Summary Form (Inorg. Form VIII)				X		
- ICP Serial Dilutions Tabulated Summary Form (Inorg. Form IX)				X		
- QC raw data – ICP, furnace, mercury, computer printouts, etc.				X	X	X
- QC sample preparation logbook pages	X	X	X	X	X	X
● MISCELLANEOUS DATA:						
- Original preparation and analysis forms or copies of preparation and analysis logbook pages	X	X	X	X	X	X
- Screening records	X	X	X			X
- All instrument output, including strip charts, from screening activities	X	X	X			X
- Preparation logs raw data	X	X	X	X	X	X
- Percent solids determination log	X	X	X	X	X	X
- Other records (e.g., telephone communication log)	X	X	X	X	X	X

VOA = volatile organic compounds
SVOA = semivolatile organic compounds
PEST = pesticide organic compounds
PCB = polychlorinated biphenyls
CN = cyanide
Other = other parameters
( ) = Form Number, refer to CLP SOW forms if CLP is used

B.5.1.4 Data Reporting Formats

Discuss procedures and/or SOPs for recording data, including guidelines for recording (manually, legibly in ink, and initialed and dated by the responsible person) and correcting data (e.g., single line drawn through errors, initialed and dated by the responsible person).

Include, as an attachment to the QAPP or within the LQAP or Laboratory QA Manual, examples of hard-copy data reporting forms and all verification checklists/forms. If applicable, discuss electronic data deliverables format and content specifications and necessary computer configuration requirements. Include, as an attachment to the QAPP or within the LQAP or Laboratory QA Manual, examples of all electronic data deliverable forms.

B.5.1.5 Data Handling and Management

Describe all computerized and manual procedures that trace the path of all data from generation to final use and storage. Alternatively, include applicable SOPs as attachments to the QAPP. Also describe the associated quality checks for error detection that are performed to ensure data integrity. The following data management steps should be addressed:

Request to Reviewers

The IDQTF Workgroup would like to incorporate references to policies for data handling and management into this section. EPA Directive 2185, Good Automatic Laboratory Practices (GALP), provides electronic data handling and management guidance and could be referenced. However, because this section deals with data handling and management in general and not specifically electronic data, the workgroup is seeking references to policies that address general data management. In addition, because this Manual applies to agencies other than EPA, the workgroup is seeking references to policies from other Federal agencies as well. Do Federal agencies other than EPA adhere to GALP? What other data management and handling policies exist?

- Data Recording
  - Provide examples of data entry forms.
  - Describe internal checks to detect errors such as transcription and calculation errors, the resultant documentation generated, and responsible personnel. Provide examples of all verification checklists/forms.

- Data Transformations/Data Reduction
  - Provide formulas used in data conversions, e.g., calculation of dry weight field sample concentrations.
  - Describe when and how data conversion procedures are performed, how they are checked, the resultant documentation generated, and responsible personnel.
  - Describe all data manipulations involved in reducing raw data to reportable data, as well as responsible personnel.

- Provide an example of how raw data are reduced for all manual and automated calculations, e.g., calculation of sample concentrations from peak areas.
- Provide references to specific software documentation for automated data processing.
- Describe internal checks to detect errors, the resultant documentation generated, and responsible personnel. Provide examples of all verification checklists/forms.
- Indicate the number of significant figures.

- Data Transfer/Transmittal
  - Identify electronic data transfer software.
  - Provide examples of electronic data transfer forms.
  - Describe manual data transcription and electronic transmittal procedures, the resultant documentation generated, and responsible personnel.
  - Describe internal checks to detect errors, the resultant documentation generated, and responsible personnel. Provide examples of all verification checklists/forms.

- Data Analysis
  - Identify and describe the data equipment and computer hardware and software that will be used to process, compile, and analyze project data (e.g., the Laboratory Information Management Systems, or LIMS), and acquired/secondary data (as discussed in Section B.4.1).
  - Describe in detail, and/or include as attachments to the QAPP, the computer models and/or algorithms that will be used for data analysis and justify their use for this project.
  - Identify hardware requirements (specifically computer disk space, memory, and speed) that will be required to run and compile modeling data.
  - Describe any specific performance requirements for the hardware/software configuration, model, or algorithm.
  - Describe computer test procedures and manual verification check procedures used to demonstrate acceptability of hardware/software configurations and computer programs and models, the resultant documentation generated, and personnel responsible. Provide examples of check data and examples of all verification checklists/forms.

- Data Assessment
  - Describe in detail, and/or include as attachments to the QAPP, the computer validation programs that will be used to validate data.
  - Describe in detail, and/or include as attachments to the QAPP, statistical computer programs that will be used to assess data.
  - Identify hardware requirements (specifically computer disk space, memory, and speed) that will be required to run validation and/or assessment software.
  - Describe computer test procedures and manual verification check procedures used to demonstrate acceptability of hardware/software configurations and computer programs,

the resultant documentation generated, and personnel responsible. Provide examples of all verification checklists/forms.
- Indicate the anticipated organization for data assessment/validation.

B.5.1.6 Data Tracking and Control

- Data Tracking
  - Describe, and/or include as attachments to the QAPP, procedures for tracking data as they are collected, transformed/reduced, transmitted, and analyzed; the resultant documentation generated; and the responsible personnel.

- Data Storage, Archival, and Retrieval
  - Describe, and/or include as attachments to the QAPP, data storage, archival, and retrieval procedures for all project data, documents, records, and reports. Differentiate between hard-copy and electronic data and information.
  - Identify specific project data, documents, records, reports, etc. that will be stored and/or archived. Differentiate between hard-copy and electronic data and information. Differentiate between documentation stored at a subcontracted laboratory and documentation archived by the Lead Organization. If data package deliverables do not include all data documentation, describe what data (for field screening, field analysis, and fixed laboratory) will be kept by which laboratory or other organization, and provide the exact physical locations (i.e., complete laboratory/organization name, address, and specific location in the building).
  - Identify the organizations and personnel that are responsible for storing/archiving/ retrieving specific project documents. Identify the responsible document control personnel, including organizational affiliation, telephone, and fax number.
  - Describe where the documents will be stored during the project and where the documents will be archived. Provide exact locations (organization name, complete address, and specific location in building) and timeframes in which documents will be moved from one location to another.
  - Indicate when documents will be archived to a final location.

- Data Security
  - Describe, and/or include as attachments to the QAPP, procedures for data security.
  - Describe, and/or include as attachments to the QAPP, procedures for computer security.

PART C. ASSESSMENT/OVERSIGHT ELEMENTS

This QAPP element group ensures that planned project activities are implemented as described in the QAPP and that reports are provided to apprise management of the project status and any quality issues that arise during implementation. Assessment activities ensure that the resultant data quality is adequate for its intended use and that appropriate responses are in place to address nonconformances and deviations from the QAPP.

Frequently, deviations from the QAPP are identified by project personnel without the benefit of formal, scheduled assessments. This section also addresses those situations and describes the process by which the need for corrective action is documented, reported, and implemented and its effectiveness assessed.

C.1 Assessments and Response Actions

This section of the QAPP identifies the number, frequency, and types of planned assessment activities that will be performed for the project. Assessments should be conducted periodically throughout the project by entities internal and/or external to the project to ensure that usable data are generated. In addition, oversight assessments should be performed by the approval authority to identify and correct nonconformances so that project quality objectives can be achieved.

Appropriately scheduled assessments allow management to implement corrective action measures in a timely manner, thereby minimizing the impact of nonconformance on achieving project quality objectives. The project quality objectives dictate the type, frequency, and extent of the assessments that should be performed.

Choose assessments that identify activities with the most influence on data quality and that provide information about potential problems and mistakes. Sampling error is generally thought to contribute the majority of the measurement error associated with project data, where:

Measurement Error = Sampling Error + Analytical Error

Therefore, it is recommended that all data generation/collection operations include at least one field sampling technical systems audit (TSA) at the start of field sampling activities so that effective corrective action measures can be implemented to mitigate the extent and impact of identified nonconformances. Investigative projects and routine monitoring projects should also include field analytical, field laboratory, and/or fixed laboratory TSAs as appropriate. A remedial investigation/ feasibility study with known human health and/or ecological risks should include comprehensive assessments of field sampling and field analytical/field laboratory/fixed laboratory measurement

procedures and proposed remediation technologies, and an evaluation of the risk assessment procedures that will be employed.

Describe activities for identifying and correcting any problems encountered during the project. An example is provided in Figure 27a.

Figure 27a. Example: Assessment and Response Actions

Figure 27a. Example: Assessment and Response Actions

The sampling of the various media will take place during the 6-week period beginning April 1, 2000. An assessment team will audit sampling activities during the first week of sampling for each media. If problems are observed, the assessment team will request a documented corrective action response and follow-up to ensure that CAs are effective. In addition, depending upon the problems identified, the assessment team may perform additional evaluations later in the sampling program. Analyses of the samples will take place during the months of April, May, and June 2000. The assessment team will purchase PE samples for the various media to be sampled and send them to the lab involved, Emerald Environmental, six weeks before the first sampling is scheduled to begin. The team assumes that the lab is experience in these analyses. If the PE data are not satisfactory, a second set of PE samples will be sent to the lab. If unsatisfactory data are produced for the second set, the assessment team will conduct a TSA at Emerald Environmental. Samples will not be sent to the lab until all issues arising from the analysis of the PE samples and the TSA (if conducted) are satisfactorily resolved. The assessment team will inform the case team promptly of its findings so that the case team can alter the sampling schedule if necessary.

C.1.1 Planned Assessments

If no assessments are planned, document this information and provide a justification in this section of the QAPP.

Project Assessment Table – Provide a Project Assessment Table that includes the information shown in QAPP Worksheet #27b. An example of a completed Project Assessment Table is provided in Figure 27b.

Figure 27b. Example: Project Assessment Table

Figure 27b. Example: Project Assessment Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment, Title and Organizational Affiliation	Person(s) Responsible for Responding to Assessment Findings, Title and Organizational Affiliation	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA), Title and Organizational Affiliation	Person(s) Responsible for Monitoring Effectiveness of CA, Title and Organizational Affiliation
Field Sampling Technical Systems Audit	*1/At startup of sampling*	*Internal*	*Chaucer Engineering*	*Claire Carpenter, Project QA Officer, Chaucer Engineering*	*James Keller, Field Sampling Coordinator, Chaucer Engineering*	*James Keller, Field Sampling Coordinator, Chaucer Engineering*	*Claire Carpenter, Project QA Officer, Chaucer Engineering*
Fixed Laboratory Technical Systems Audit	*1/Prior to sample receipt*	*External*	*Chaucer Engineering*	*Claire Carpenter, Project QA Officer, Chaucer Engineering*	*John Grissom, Laboratory QA/QC Manager, Austin Laboratories*	*John Grissom, Laboratory QA/QC Manager, Austin Laboratories*	*John Grissom, Laboratory QA/QC Manager, Austin Laboratories*

Many different types of assessments are available for evaluating the effectiveness of project activities. The following may be performed as internal or external assessments by project participants or as oversight audits by the approval authority.

Field Sampling Technical Systems Audit (TSA) – A thorough on-site audit during which sampling design, equipment, instrumentation, supplies, personnel, training, sampling procedures, chain-of-custody, sample handling and tracking, data reporting, data handling and management, data tracking and control, and data verification procedures are examined for conformance with the QAPP. It is recommended that at least one field sampling TSA be performed at the start of field sampling activities so that effective corrective action measures can be implemented to mitigate the extent and impact of identified nonconformances.

Field Analytical TSA – A thorough audit of on-site field analytical techniques (not performed in a mobile field laboratory) during which the equipment, instrumentation, supplies, personnel, training, analytical methods/procedures, sample handling and tracking, data reporting, data handling and management, data tracking and control, and data verification procedures are checked for conformance with the QAPP. A field analytical TSA can be performed prior to the start of, at the start of, or at any time during field sampling activities. However, it is recommended that at least one field analytical TSA be performed prior to the start of the field sampling activities so that effective corrective action measures can be implemented to mitigate the extent and impact of identified nonconformances.

Field Laboratory TSA – A thorough audit of an on-site field laboratory during which the facility (e.g., mobile lab, trailer, etc.), equipment, instrumentation, supplies, personnel, training, analytical methods/procedures, laboratory procedures, sample handling and tracking, data reporting, data handling and management, data tracking and control, and data verification procedures are checked for conformance with the QAPP. A field laboratory TSA can be performed prior to the start of, at the start of, or at any time during field sampling activities. However, it is recommended that at least one field laboratory TSA be performed prior to the start of the field sampling activities so that effective corrective action measures can be implemented to mitigate the extent and impact of identified nonconformances.

Fixed Laboratory TSA – A thorough audit of a fixed laboratory during which the facility, equipment, instrumentation, supplies, personnel, training, analytical methods/procedures, laboratory procedures, sample handling and tracking, data reporting, data handling and management, data tracking and control, and data verification procedures are checked for conformance with the QAPP. A fixed laboratory TSA can be performed prior to the start of, at the start of, or at any time during field sampling activities. However, it is recommended that at least one fixed laboratory TSA be performed prior to the start of the field sampling activities so that effective corrective action measures can be implemented to mitigate the extent and impact of identified nonconformances.

Split Sampling and Analysis Audit – A comparison study to assess interlaboratory precision and accuracy. Split samples are collected by the investigative organization. The sampler collects one field sample and then physically splits it into two representative sample aliquots. One split sample is analyzed by the audit laboratory and the other by the investigative organization. Split samples quantitatively assess the measurement error introduced by the organization's sample shipment and analysis system. Split sample comparability criteria must be generated prior to sample collection and documented in an approved QAPP. Refer to Diagram 2 (Section A.7.2), Example: Data Comparison Flow Diagram and Criteria for Individual Aqueous Split Sample Results.

Performance Evaluation Sample Tracking and Analysis – Results from performance evaluation samples (PESs) are statistically analyzed to provide information on routine laboratory performance and the overall accuracy and bias of the analytical method. The QAPP must address the selection of appropriate PESs. Factors to consider include, but are not limited to, whether they are single or double blind, analyte selection, native or synthetic matrix, spiked or natively contaminated or both, multiple matrices and concentrations, total number of PESs, and analytical methods.

Data Validation TSA – A thorough review of the complete Data Validation Report, including a review of the associated analytical data package deliverables (tabulated and raw data) to ensure that all required analytical data package deliverables and Data Validation Report components were provided and contain the specified information. The Data Validation TSA also ensures that the data validation criteria specified in the QAPP were met, and the method- and laboratory-specific QC acceptance criteria specified in the QAPP were met and were appropriate for achieving the project measurement performance criteria. The Data Validation TSA also evaluates whether the project-specific measurement performance criteria and data validation criteria were appropriate for meeting the specified DQOs and whether analytical measurement performance usability issues affected DQO achievement.

Data Package TSA – This is a type of Data Validation TSA that is limited to a review of the complete analytical data package deliverable generated by the field and/or fixed laboratory or organization to ensure that all required deliverables (tabulated and raw data) are provided and contain all the information required to reproduce all reported results. The Data Package TSA also ensures that the data verification procedures specified in the QAPP were used by the laboratory/organization producing the analytical data package deliverable. The Data Package TSA ensures that the method- and laboratory-specific QC acceptance criteria specified in the QAPP were met and were appropriate for achieving the project measurement performance criteria.

Management Systems Review (MSR) – A review of an organization or organizational subset to determine if the management structure, policies, and procedures are sufficient to ensure that an effective quality system is in place to support the generation of usable project data.

Audit Checklists - Project-specific questionnaires and checklists used when performing assessments. Completed checklists should be attached to the QA Management Reports as described in Section C.2. Include project-specific audit checklists as attachments to the QAPP. An example of the Laboratory Evaluation Summary questionnaire form is included in Appendix 5.

Note: Written oversight reports and split sampling results, and subsequent corrective action responses generated by the investigative organization, should be included in QA Management Reports and final project reports.

C.1.2 Assessment Findings and Corrective Action Responses

In this section of the QAPP, describe how QAPP deviations and project deficiencies, which are identified through the planned project assessments, will be handled. An example of a Technical Systems Audit Report is included in Appendix 6. Assessment findings that require corrective action initiate a sequence of events that include documentation of deficiencies, notification of findings, request for corrective action, implementation of corrective action, and follow-up assessment of the corrective action's effectiveness.

For each type of assessment:

- Describe how deficiencies will be documented and communicated (e.g., verbal debriefing after audit and/or written audit report).
- Describe what type of corrective action responses will be required and how corrective action responses will be documented.
- Identify who will be notified of audit findings. Provide the name, title, organizational affiliation, position, and telephone/fax number of all individuals who must be notified of deficiencies/nonconformances.
- Identify to whom the corrective action responses will be directed and in what timeframe.
- Include timeframes allowed for the notification of audit findings, the request for corrective action, and the transmittal of corrective action responses.

The required information may be presented in tabular format. It can be attached to OPTIONAL QAPP Worksheet #27, if used.

The content and format of corrective action responses should be tailored to suit the project quality objectives. In certain situations, a letter documenting specific procedural changes may be a sufficient corrective action response. Appropriate procedural changes can include, but are not limited to, additional staff training, revision of SOPs, and rescheduling of field and analytical activities (e.g., to ensure holding times are met). Corrective actions that require immediate implementation to

ensure that project quality objectives are met may require work to cease until those corrective actions are implemented and their effectiveness verified.

C.1.3 Additional QAPP Nonconformances

Corrective action procedures also must be implemented when deviations from the QAPP are noted by project personnel outside of the formal assessment process. In other words, corrective action needs to be initiated whenever project personnel identify field sampling and/or analytical problems that could potentially affect data quality and/or usability. Such incidents should be documented and resolved using the procedures and personnel for planned assessments that will have been described in Sections C.1.1 and C.1.2 of the QAPP.

C.2 QA Management Reports

Planned QA Management Reports ensure that management and stakeholders are periodically updated on the project status and the results of all QA assessments. Efficient communication of project status and problems allows management to implement timely and effective corrective actions so that project quality objectives can be met.

QA Management Reports Table – Provide a QA Management Reports Table that contains the information shown in OPTIONAL QAPP Worksheet #28. Identify the frequency and types of planned QA Management Reports, the projected delivery dates, the personnel responsible for report preparation, and the report recipients. An example of a completed QA Management Reports Table is provided in Figure 28.

Figure 28. Example: QA Management Reports Table

Figure 28. Example: QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation, Title, and Organizational Affiliation	Report Recipient(s), Title, and Organizational Affiliation
Verbal Status Report	*Daily*	*At the end of every day of field activities*	*James Keller, Field Sampling Coordinator, Chaucer Engineering*	*Dorothy Parker, Project Manager/Geotechnical Engineer, Chaucer Engineering*
Verbal or Written Status Report	*As necessary*	*As necessary*	*Dorothy Parker, Project Manager/Geotechnical Engineer, Chaucer Engineering*	*Howard Fast, Poe Recycling Project Manager, Poe Recycling*
Field Sampling Technical Systems Audit Report	*1/At startup of sampling*	*3/15/98*	*Claire Carpenter, Project QA Officer, Chaucer Engineering*	*Dorothy Parker, Project Manager/Geotechnical Engineer & James Keller, Field Sampling Coordinator, Chaucer Engineering; Howard Fast, Poe Recycling Project Manager, Poe Recycling*
Fixed Laboratory Technical Systems Audit Report	*1/Prior to sample receipt*	*2/15/98*	*Claire Carpenter, Project QA Officer, Chaucer Engineering*	*John Grissom, Laboratory QA/QC Manager & Robert Galvani, Laboratory Manager, Austin Labs; Howard Fast, Poe Recycling Project Manager, Poe Recycling; Dorothy Parker, Project Manager/Geotechnical Engineer, Chaucer Engineering*
Data Assessment Report	*1/After all data are generated and validated*	*6/7/98*	*Brendan Rivers, Data Validator, BDO Quality Services; Claire Carpenter, Project QA Officer, Chaucer Engineering*	*Dorothy Parker, Project Manager/Geotechnical Engineer, Chaucer Engineering; Howard Fast, Poe Recycling Project Manager, Poe Recycling; Henry Thoreau, EPA Project Manager, EPA-NE*
Final Project Report	*1/After QA Management Reports and risk assessment completed*	*7/6/98*	*Dorothy Parker, Project Manager/Geotechnical Engineer, Chaucer Engineering*	*Howard Fast, Poe Recycling Project Manager, Poe Recycling; Henry Thoreau, EPA Project Manager, EPA-NE*

Describe the content of QA Management Reports that will be generated for the project. Assessment checklists and reports, and requests for corrective actions letters (refer to Section C.1), should be included as attachments to the QA Management Reports. Also, copies of all corrective action response letters should be included as attachments to the QA Management Reports.

QA Management Reports should include an evaluation of measurement error as determined from the assessments.

All QA Management Reports must be included in the Final Project Report. If no QA Management Reports are generated for the project, then a QA/QC section that discusses the following issues must be included in the Final Project Report:

- Summary of project QA/QC programs and trainings conducted during the project
- Conformance of project activities to QAPP requirements/procedures
- Status of project and schedule delays
- Deviations from the approved QAPP and approved amendments to the QAPP
- Results and trends of PESs by laboratory (per parameter, matrix, and concentration level)
- Description and findings of TSAs and other assessments
- Results of data validation activities in terms of amount of usable data generated
- Required corrective actions and effectiveness of corrective action implementation
- Data quality assessments in terms of precision, accuracy, representativeness, completeness, comparability, and sensitivity (refer to Section D.2)
- Limitations on the use of measurement data generated

The Final Project Report must meet project quality objectives and, at a minimum, include:

- Development of project quality objectives, narrative, and timeline of project activities
- Summary of major/critical problems encountered and their resolution
- Data summary including tables, charts, and graphs with appropriate sample identification/ station location numbers, concentration units, percent solids (if applicable), and data quality flags
- Reconciliation of project data with project quality objectives
- Conclusions and recommendations
- All QA Management Reports (as attachments to the Final Project Report document) and/or the QA/QC section that addresses the issues listed above

PART D. DATA VERIFICATION/VALIDATION AND USABILITY ELEMENTS

This QAPP element group encompasses the activities used to ensure that only scientifically sound data that are of known and documented quality and that meet project quality objectives are used in making environmental decisions. The data review approach must be of a level appropriate to the project requirements.

This QAPP Manual defines two distinct evaluative steps that are required to ensure that project data quality needs are met:

1. **Data Verification/Validation** – Data verification/validation consists of evaluating the completeness, correctness, and conformance or contractual compliance of a data set against the method standard, SOP, or contract requirements documented in the project QAPP. This activity should be performed internally by the analytical group or fixed laboratory generating the data. Data can be checked by an entity external to the analytical group or fixed laboratory. In addition, the qualification of data beyond method, procedure, or contract compliance is done to determine the analytical quality of a specific data set. These criteria are based on the measurement performance criteria developed in Section A.7 of the project QAPP. This QAPP Manual states that this activity ***must*** be performed by an organization independent of the group that generates the data. Data verification/validation results in accepted, qualified, or rejected data.

2. **Data Usability Assessment** – Data usability assessment is the process of evaluating verified/validated data to determine if they can be used for the purpose of the project, i.e., to answer the environmental question or to make the environmental decisions that must be made. Data usability assessment includes the following sequence of evaluations:

   – First, individual data sets are evaluated to identify the measurement performance/ usability issues/problems affecting the ultimate achievement of DQOs.

   – Second, an overall evaluation of ***all*** data generated for the project is performed.

   – Finally, the project-specific measurement performance criteria and data verification/ validation criteria documented in the QAPP are evaluated to determine if they were appropriate for meeting DQOs.

In order to perform either of the data evaluation steps above, it is necessary that reported data be supported by complete data packages (as itemized in Tables 5 and 6 of Section B.5.1.3), which include sample receipt and tracking information, chain-of-custody records, tabulated data summary

forms and raw analytical data for all field samples, standards, QC checks and QC samples, and all other project-specific documents that are generated.

If relevant raw data and/or sample information documenting data quality are not available, then data verification/validation cannot be performed and only a limited data review can be performed. This QAPP Manual defines reviews of data/information that do not have sufficient, documented QC as "limited data reviews" (LDRs). LDRs result in unquantifiable measurement error and an unknown degree of uncertainty associated with the data. Such data are considered to be unknown and of undocumented quality. Ultimately, decisions that are made based on the data may be wrong. Data that are of unknown or undocumented quality should only be used in exceptional circumstances. Resampling or reanalysis must be considered first.

D.1 Data Verification and Validation

D.1.1 Requirements

Verification and validation procedures and criteria must be established prior to data evaluation. Specific project verification and validation criteria are developed to identify and qualify data that do not meet the measurement performance criteria as established in Section A.7. Data verification and validation criteria and procedures are documented in this section of the QAPP to ensure that data are evaluated properly, completely, and consistently for use in meeting project quality objectives.

Specify the data validation process that will be used to verify/validate sample collection, handling, field analysis, and analytical laboratory project data. Identify the specific data validation process that will be used for each analytical parameter, matrix, and concentration level.

Verification/Validation Criteria Documents – The procedures used to verify/validate data must be explained in detail in this section of the QAPP. Validation guidance and documents can be attached to the QAPP.

Document the procedures and criteria used to verify and validate data information operations. These operations include, but are not limited to, the electronic and/or manual transfer, entry, use, and reporting of data for computer models, algorithms, and databases; correlations studies between variables; data plotting and so forth.

Request to Reviewers

The IDQTF Workgroup is soliciting comments on how to handle and give direction on the issues of data verification and validation. Many entities have working definitions that make strong distinctions between these terms, while others, for practical purposes, use the terms interchangeably. What direction/instructions should be in these sections? Should verification and validation be addressed separately? What are good definitions for these terms? What procedures should be followed?

D.1.2 Procedures

This section of the QAPP describes the process that will be followed to verify and validate project data. Provide a Data Verification/Validation Process Table containing the information shown in the example in Figure 29a.

Figure 29a. Example: Data Verification/Validation Process Table

Figure 29a. Example: Data Verification/Validation Process Table

Verification/ Validation Task	Description	I/E	Responsible for Verification/ Validation (Name, Organization)
Chain-of-custody & shipping forms	*Chain-of-custody forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. When everything checks out, the shippers signature on the chain-of-custody will be is initialed by the reviewer, a copy of the chain-of-custody will be retained in the site file, and the original and remaining copies will be taped inside the cooler for shipment. See chain-of-custody SOP for further details.*	*I*	*Cole Lector* *Jewel Engineering*
Audit Reports	*Upon report completion, a copy of all audit reports will be placed in the site file. If corrective actions are required, a copy of the documented corrective action taken will be attached to the appropriate audit report in the site file. At the beginning of each week, and at the completion of the site work, site file audit reports will be reviewed internally to ensure that all appropriate corrective actions have been taken and that corrective action reports are attached. If corrective actions have not been taken, the site manager will be notified to ensure action is taken.*	*I*	*A. K. DeBeers* *Jewel Engineering*
Laboratory Data	*All laboratory data packages will be verified internally by the laboratory performing the work for completeness prior to submittal. The laboratory shall complete DC-2 forms documenting the organization and complete contents of each data package.* *All received data packages will be verified externally according to the data validation procedures specified in Figure 29b.*	*I* *E*	*Jasper Sanquin* *Emerald Environmental Lab* *G. R. Flawless* *Validation Services*
DV Reports	*All data validation reports received from the data validators will be verified externally for completeness. One out of every 10 samples will be verified against the original laboratory results to check for transcription errors.*	*E*	*Manny Facets* *Jewel Engineering*

Describe how sample collection, handling, and field analysis procedures will be verified/validated internally against the measurement performance criteria specified in Section A.7. Describe how verification/validation of field sampling, handling, and analysis activities will be documented (e.g., QC signatures in field logs, QC checklist, etc.). Describe which sampling, handling, field analytical, and fixed laboratory data will be verified/validated internally at the data generator level. Describe the end product of laboratory verification (e.g., laboratory-qualified data).

Describe which handling, field analytical, and fixed laboratory data will be verified/validated by entities external to the data generator.

Describe the matrices, concentration levels, and analytical parameters for which each data verification/validation group will be responsible. It is recommended that this information be provided in a table.

Data Verification/Validation Summary Table – Provide a Data Verification/Validation Summary Table that contains the information shown on OPTIONAL QAPP Worksheet #29b. Identify the matrices, analytical parameters, and concentration levels for which each data verification/validation group will be responsible, as well as the verification/validation criteria that will be used to verify/validate those data. Identify by title (Lead Chemist, Project Chemist, etc.) and organizational affiliation the person who is ultimately responsible for data verification/validation. This is the person who will sign the project Data Verification/Validation Reports.

An example of a Data Verification/Validation Summary Table is shown in Figure 29b.

Figure 29b. Example: Data Verification/Validation Summary Table

Figure 29b. Example: Data Verification/Validation Summary Table

Medium/ Matrix	Analytical Parameter	Concentration Level	Verification/Validation Criteria	Data Verificator/Validator (Title and organizational affiliation)	Responsibility for Data Verification/Validation (Title and organizational affiliation)
Soil	*VOA*	*Low*		*Junior Chemist, Best Review Company, Somersville, MA 03215, Tel: 617 832-5621*	*Lead Chemist, Whole World Consulting, Inc., Bodewell, NH 06321, Tel: 593 825-8213*
Soil	*SVOC*	*Low/Medium*		*Junior Chemist, Best Review Company, Somersville, MA 03215, Tel: 617 832-5621*	*Lead Chemist, Whole World Consulting, Inc., Bodewell, NH 06321, Tel: 593 825-8213*
GW	*Metals*	*Low/Medium*		*Senior Chemist, Whatayuk Consulting, Axeville, ME 15231, Tel: 563 831-2568*	*Lead Chemist, Whole World Consulting, Inc., Bodewell, NH 06321, Tel: 593 825-8213*

D.2 Data Usability and Reconciliation with Data Quality Objectives

This section of the QAPP describes how verified/validated project data will be reconciled with the data quality objectives, how data quality issues will be addressed, and how limitations on the use of the data will be reported and handled. The section describes the scientific and statistical procedures/ methods that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision-making for the project.

Note: Data quality assessment is the final step in data evaluation and can only be performed on data of known and documented quality, that is, verified/validated data.

Summarize the data assessment process and all data assessment procedures, including statistics, equations, and computer algorithms, that will be used to assess data. Describe the data generation reporting formats and the documentation that will be generated during data assessment. Identify the personnel (by title and organizational affiliation) responsible for performing the data usability assessment. Optional QAPP Worksheet #30, found in Appendix 1, can be used for this purpose.

A Formal Data Quality Assessment (DQA) Process is described in *Guidance for the Data Quality Assessment Process: Practical Methods for Data Analysis*, EPA QA/G-9, July 1996. EPA QA/G-9 provides guidance on many statistical and graphical assessment tools. The Formal DQA Process consists of five steps:

1. Review DQOs and sampling design
2. Conduct preliminary data review
3. Select statistical test
4. Verify assumptions
5. Draw conclusions from the data

Request to Reviewers

What specific DoD and DOE documents are equivalent guidance documents to EPA QA/G-9?

Even if the Formal DQA Process is not followed in its entirety, a systematic assessment of the data quality must be performed. This process should include a preliminary data review. It is recommended that the QAPP include a flow diagram to describe the data quality assessment process for the project.

Describe how data will be presented in order to identify trends, relationships (correlations), and anomalies.

Describe the evaluative procedures used to assess overall measurement error associated with the project and include the following data quality indicators (DQIs).

Precision

In order to meet the needs of the data users, project data must meet the measurement performance criteria for precision specified in Section A.7.2 of the QAPP.

Project Precision (Field Duplicates/Replicates): Include formulae for calculating precision for individual duplicate/replicate data points (e.g., RPD, RSD, standard deviation (SD)).

Analytical Precision (Laboratory Duplicates/Replicates, etc.): Include the formulae for calculating analytical precision for individual duplicate/replicate data points (e.g., RPD, RSD, SD).

Overall Precision: Describe the procedures used to perform overall assessment of precision in terms of the entire set of project data and include mathematical and/or statistical formulae for evaluating overall precision.

Poor overall precision may be the result of one or more of the following: field instrument variation, analytical measurement variation, poor sampling technique, sample transport problems, and/or spatial variation (heterogeneous sample matrices). In order to identify the cause of imprecision, the field sampling design rationale and sampling techniques should be evaluated by the reviewer, and both field and analytical duplicate/replicate sample results should be reviewed. If poor precision is indicated in both the field and analytical duplicates/replicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate/replicate results, then the sampling technique, field instrument variation, sample transport, and/or spatial variability may be the source of error.

If Data Validation Reports indicate that analytical imprecision exists for a particular data set or sample delivery group (SDG), then the impact of that imprecision on data usability must be discussed in the Data Assessment Report.

The Data Assessment Report should discuss and compare overall field duplicate precision data from multiple data sets collected for the project for each matrix, analytical parameter, and concentration level. Data Assessment Reports should describe the limitations on the use of project data when overall precision is poor or when poor precision is limited to a specific sampling or laboratory/analytical group, data set/SDG, matrix, analytical parameter, or concentration level.

When project-required precision is not achieved and project data are not usable to adequately address environmental questions (i.e., determining if regulatory/technical Action Limits have been exceeded) and to support project decision-making, then the Data Assessment Report should address how this problem will be resolved and discuss the potential need for resampling.

Accuracy/Bias

In order to meet the needs of the data users, project data must meet the measurement performance criteria for accuracy/bias specified in Section A.7.2 of the QAPP.

Sample Contamination: Discuss how the QC activities and QC check and sample data will be reviewed to evaluate the accuracy and potential bias of sample results. If field contamination exists, then the impact of field contamination on data usability must be discussed in the Data Assessment Report, and the field sampling team leader and Project Manager should be notified. Differentiate field sample collection and transport contamination (equipment/rinsate blanks, trip blanks) from contamination introduced at the time of sample preparation and/or analysis (i.e., method blank, storage blank, analytical instrument blanks). Note that sample contamination may result in either a negative or positive bias. For example, improperly cleaned sample containers for metal analysis may result in the retention of metals on the interior container walls. This would result in lower metals concentrations being reported than are actually present in the collected sample (i.e., a negative bias). A positive bias would occur when sample container contamination results in an additive effect, i.e., reported analyte concentrations are higher than the true sample concentrations for that analyte.

Analytical Accuracy/Bias: Discuss how the QC activities and QC check and sample data will be used to evaluate the accuracy and potential bias of sample results. Include methods/formulae for calculating analytical accuracy and bias for spike samples/compounds (matrix spikes, surrogate spikes, SRMs, LCSs, etc.), PESs, calibration linearity, results of calibration verification checks, etc. If Data Validation Reports indicate that contamination and/or analytical inaccuracies/bias exist for a particular data set/SDG, then the impact of that contamination and/or analytical inaccuracy/bias on data usability must be discussed in the Data Assessment Report.

Overall Accuracy/Bias: Describe the procedures used to perform overall assessment of accuracy/bias in terms of the entire set of project data and include mathematical and/or statistical formulae for evaluating overall accuracy/bias. Describe the procedures for evaluating the overall qualitative and quantitative bias trends in PES data.

The Data Assessment Report should discuss and compare overall contamination and accuracy/bias data from multiple data sets collected for the project for each matrix, analytical parameter, and concentration level. The Data Assessment Report should describe the limitations on the use of project data if extensive contamination and/or inaccuracy/bias exists or when it is limited to a specific sampling or laboratory/analytical group, data set/SDG, matrix, analytical parameter, or concentration level. The Data Assessment Report should identify qualitative and/or quantitative bias trends in multiple PES results for each matrix, analytical parameter, and concentration level. The impact of any qualitative and/or quantitative trends in bias on the sample data should be discussed.

Any PESs that have false positive and/or false negative results should be reported and the impact on data usability should be discussed in the Data Assessment Report.

When project-required accuracy/bias is not achieved and project data are not usable to adequately address environmental questions (i.e., determining if regulatory/technical Action Limits have been exceeded) and to support project decision-making, then the Data Assessment Report should address how this problem will be resolved and discuss the potential need for resampling.

Sample Representativeness

In order to meet the needs of the data users, project data must meet the measurement performance criteria for sample representativeness specified in Section A.7.2 of the QAPP.

Discuss how the QA/QC activities (review of sampling SOPs, field sampling TSAs, split sampling and analysis audits, etc.) and QC check and sample data will be reviewed to assess sample representativeness. If field duplicate precision checks indicate potential spatial variability, then this may trigger additional scoping meetings and subsequent resampling in order to collect data that are more representative of a nonhomogeneous site.

The Data Assessment Report should discuss and compare overall sample representativeness for each matrix, parameter, and concentration level. Data Assessment Reports should describe the limitations on the use of project data when overall nonrepresentative sampling has occurred or when nonrepresentative sampling is limited to a specific sampling group, data set/SDG, matrix, analytical parameter, or concentration level. If data are not usable to adequately address environmental questions and/or support project decision-making, then the Data Assessment Report should address how this problem will be resolved and discuss the potential need for resampling.

Comparability

In order to meet the needs of the data users, project data must meet the measurement performance criteria for comparability specified in Section A.7.2 of the QAPP.

Include methods/formulae for assessing data comparability for each matrix, analytical parameter, and concentration level.

If two or more sampling procedures and/or sampling teams will be used to collect samples, describe how comparability will be assessed for each matrix, analytical parameter, and concentration level.

If two or more analytical methods/SOPs will be used to analyze samples of the same matrix and concentration level for the same analytical parameter, describe how comparability will be assessed between the two data sets.

If field screening data will be confirmed by full-protocol methods, document the specific method references and percent difference formula that will be used to assess comparability for individual data points (refer to Section A.7.2). To document overall comparability, describe the procedures used to perform overall assessment of comparability and include mathematical and/or statistical formulae for evaluating screening and confirmatory data comparability.

If split samples are analyzed for EPA oversight, document the specific method references and percent difference formula that will be used to assess split sample comparability for individual data points (refer to Section A.7.2). To document overall comparability, describe the procedures used to perform overall assessment of oversight split sampling comparability and include mathematical and/or statistical formulae for evaluating oversight split sampling data comparability.

For long-term monitoring projects, data comparability is extremely important. Project data should be compared to previously generated data to ascertain the possibility of false positives and/or false negatives and negative and/or positive trends in bias. Anomalies detected in the data may reflect a changing environment or indicate sampling and/or analytical error. Comparability criteria should be established to evaluate these data sets in order to identify outliers and trigger resampling as warranted.

The Data Assessment Report should discuss and compare overall comparability between multiple data sets collected for the project for each matrix, analytical parameter, and concentration level. The Data Assessment Report should describe the limitations on the use of project data when project-required data comparability is not achieved for the overall project or when it is limited to a specific sampling or laboratory/analytical group, data set/SDG, matrix, analytical parameter, or concentration level.

If screen/confirmatory comparability criteria are not met, then this should be documented in the Data Assessment Report and the impact on data usability should be discussed therein. Likewise, if oversight split sampling comparability criteria are not met, then the Data Assessment Report should document this and discuss the impact on data usability. If data are not usable to adequately address environmental questions and/or support project decision-making, then the Data Assessment Report should address how this problem will be resolved and discuss the potential need for resampling.

Finally, if long-term monitoring data are not comparable, then the Data Assessment Report should address whether the data indicate a changing environment or are a result of sampling and/or analytical error. If data are not usable to adequately address environmental questions and/or support

project decision-making, then the Data Assessment Report should address how this problem will be resolved and discuss the potential need for resampling.

Sensitivity and Quantitation Limits

In order to meet the needs of the data users, project data must meet the measurement performance criteria for sensitivity and QLs specified in Section A.7.2 of the QAPP.

Include methods/formulae for calculating analytical sensitivity that ensure QLs are achieved (e.g., percent recovery of laboratory-fortified blank spiked compounds and PESs). Also, include procedures for evaluating low point calibration standards run at the QL. Low point calibration standards should produce a signal at least 10 times the background noise level and should be part of a linear calibration curve.

Document the procedures for calculating MDLs, QLs, and SQLs.

Overall Sensitivity and Quantitation Limits: Describe the procedures used to perform overall assessment of sensitivity and QLs in terms of the entire set of project data, and include mathematical and/or statistical formulae for evaluating sensitivity and QLs.

If Data Validation Reports indicate that sensitivity and/or QLs were not achieved, then the impact of that lack of sensitivity and/or higher QLs on data usability must be discussed in the Data Assessment Report.

The Data Assessment Report should discuss and compare overall sensitivity and QLs from multiple data sets collected for the project for each matrix, analytical parameter, and concentration level. Data Assessment Reports should describe the limitations on the use of project data if project-required sensitivity and QLs were not achieved for all project data or when it is limited to a specific sampling or laboratory/analytical group, data set/SDG, matrix, analytical parameter, or concentration level.

When project-required QLs are not achieved and project data are not usable to adequately address environmental questions (i.e., determining if regulatory/technical Action Limits have been exceeded) and to support project decision-making, then the Data Assessment Report should address how this problem will be resolved and discuss the potential need for resampling. In this case, the Data Assessment Report should clearly differentiate between usable and unusable data for the data users.

Data Limitations and Actions

Describe what actions will be taken when data do not meet the project quality objectives. It is necessary to document, in this section of the QAPP, the exact process for handling data that do not meet project quality objectives (i.e., when DQIs do not meet measurement performance criteria). Depending on how those data will be used, the process should specify the restrictions on use of those data for environmental decision-making.

Sources of sampling and analytical error should be identified and corrected as close as possible to the onset of sample collection activities. Incorporating an ongoing data assessment process throughout the project, rather than just as a final step, will facilitate the early detection and correction of problems, thereby ensuring that project quality objectives are met.

Completeness

In order to meet the needs of the data users, project data must meet the measurement performance criteria for data completeness specified in Section A.7.2 of the QAPP.

Include the methods/formulae for calculating data completeness. Describe how the amount of valid data will be determined as a percentage of the number of valid measurements that should have been collected for each matrix, analytical parameter, and concentration level. When certain sample locations and/or analytes and matrices are more critical than others in making project decisions, describe how critical data will be assessed for completeness.

Overall Completeness: Describe the procedures used to perform overall assessment of completeness in terms of the entire set of project data and include mathematical and/or statistical formulae for evaluating overall completeness.

The Data Assessment Report should discuss and compare overall completeness of multiple data sets collected for the project for each matrix, analytical parameter, and concentration level. Data Assessment Reports should describe the limitations on the use of project data if project-required completeness was not achieved for the overall project or when it is limited to a specific sampling or laboratory/analytical group, data set/SDG, matrix, analytical parameter, or concentration level.

When project-required completeness is not achieved and sufficient data are not available to adequately address environmental questions and support project decision-making, then the Data Assessment Report should address how this problem will be resolved and discuss the potential need for additional resampling.

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Appendix 1

OPTIONAL QAPP Worksheets

Note: It is recommended but not required that these worksheets be taken to initial project scoping meetings and completed. They will help to identify critical project information that will help to ensure that data are the right type, quality, and quantity needed to meet project quality objectives.

The completed worksheets can be used by the QAPP preparer or preparation team for incorporation into the QAPP document.

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OPTIONAL QAPP Worksheet #1
Title and Approval Page

Site Name/Project Name:
Site Location:

Title:
Revision Number:
Revision Date:
Page_____ of _____

_____
Document Title

_____
Lead Organization (Agency, State, Tribe, Federal Facility, PRP, or Grantee)

_____
Preparer's Name and Organizational Affiliation

_____
Preparer's Address and Telephone Number

_____
Preparation Date (Day/Month/Year)

Investigative Organization's Project Manager:_____
Signature

_____
Printed Name/Organization/Date

Investigative Organization's Project QA Officer: _____
Signature

_____
Printed Name/Organization/Date

Lead Organization's Project Officer :_____
Signature

_____
Printed Name/Organization/Date

Approval Signatures: _____
Signature

_____
Printed Name/Title/Date

_____
Approval Authority

Other Approval Signatures: _____
Signature

_____
Printed Name/Title/Date

Document Control Number:
_____

OPTIONAL QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project Name:
Site Location:
Site Number/Code:
Operable Unit:
Contractor Name:
Contractor Number:
Contract Title:
Work Assignment Number:

Title:
Revision Number:
Revision Date:
Page_____ of _____

1. Identify guidance used to prepare QAPP:
   _____
2. Identify program: _____
3. Identify approval entity: _____
4. Indicate whether the QAPP is a generic program QAPP or a project-specific QAPP. (circle one)
5. List dates of scoping meetings that were held:_____
6. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Approval Date
_____	_____
_____	_____
_____	_____
_____	_____

7. List organizational partners (stakeholders) and connection with Lead Organization:
   _____
   _____
8. List data users:_____
   _____
   _____
9. If any required QAPP elements (1- 20), worksheets and/or required information are not applicable to the project, then circle the omitted QAPP Elements, Worksheets and Required Information on the attached Table. Provide an explanation for their exclusion below:
   _____
   _____
   _____
   _____

OPTIONAL QAPP Worksheet #3
List people who will receive the approved QAPP, QAPP revisions, addenda, and/or amendments.

Title:
Revision Number:
Revision Date:
Page ____ of ____

Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Document Control Number

OPTIONAL QAPP Worksheet #4
Copies of this form must be signed by project personnel from each organization to indicate that they have read the QAPP and will implement the QAPP as prescribed. Each organization should forward signed sheets to the central project file.

Title:
Revision Number:
Revision Date:
Page _____ of _____

Project Personnel Sign-Off Sheet

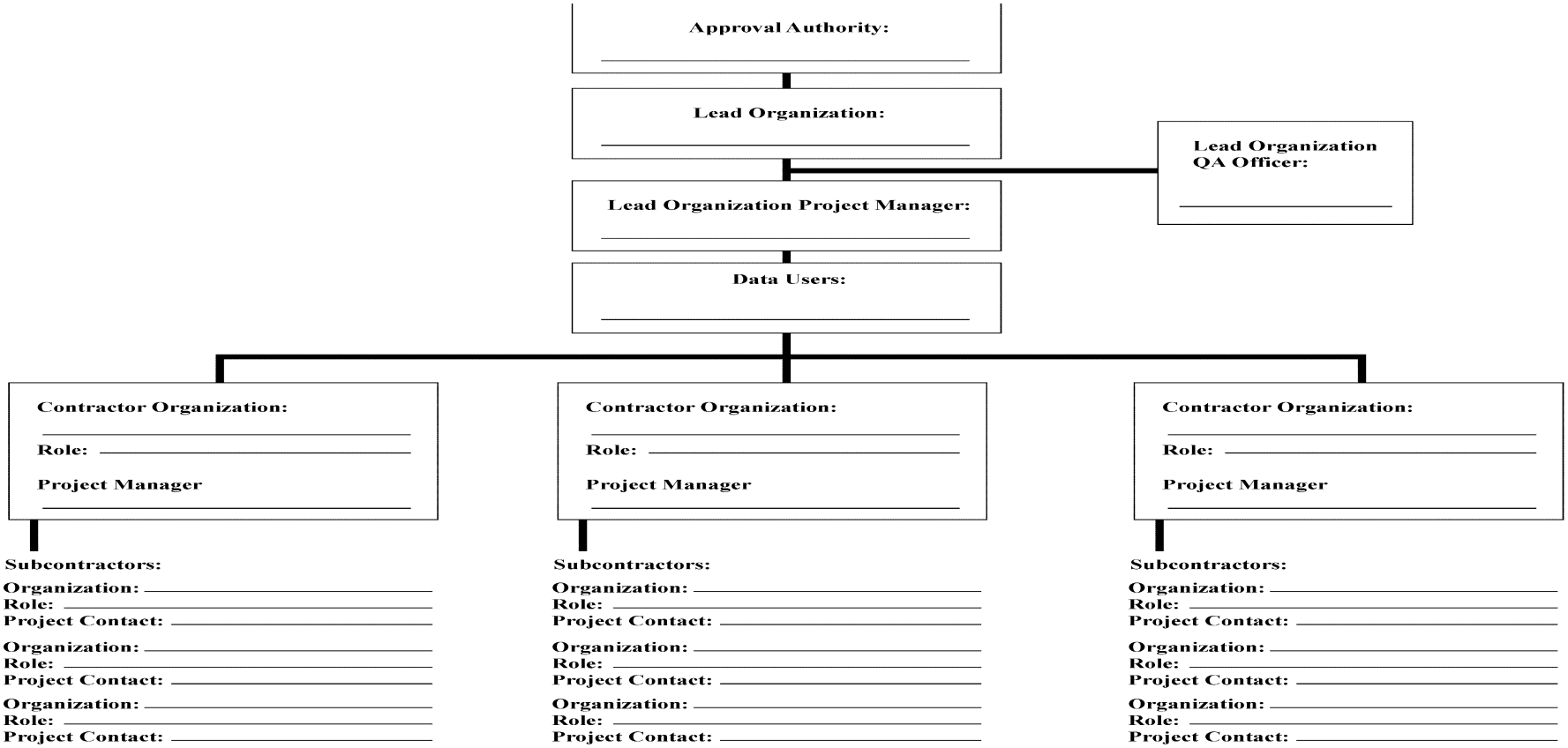
Organization:_____

Title	Telephone Number	Signature	Date QAPP Read	QAPP Acceptable as Written

OPTIONAL QAPP Worksheet #5
Identify reporting relationships between Lead Organization and other organizations, including contractors and subcontractors. Include the name and phone number of each organization and the Project Manager, Case Team member, and/or Project Contacts for each organization. (Refer to *QAPP Manual* Section A.4.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page _____ of _____

Organizational Chart



99-138.10

OPTIONAL QAPP Worksheet #6
Identify project personnel associated with each organization, contractor, and subcontractor participating in responsible project functions. Include their title, the name of organization for whom they work, and their project responsibilities. Indicate Project Team members with an "*". Attach resumes to this worksheet. (Refer to *QAPP Manual* Section A.4.3 for guidance.)

Title:
Revision Number:
Revision Date:
Page _____ of ____

Personnel Responsibilities and Qualifications Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications

OPTIONAL QAPP Worksheet #7
Provide the following information for those projects requiring specialized training. Attach training records and/or certificates to this worksheet.
(Refer to *QAPP Manual* Section A.4.4 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Special Personnel Training Requirements Table

Project Function	Specialized Training – Title of Course or Description	Training Provided By	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates*

*If training records and/or certificates are on file elsewhere, document their location in this column. If training records and/or certificates do not exist or are not available, then this should be noted.

OPTIONAL QAPP Worksheet #8
Complete this worksheet for each project scoping meeting held. Attach meeting agenda and notes. (Refer to *QAPP Manual* Section A.5.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Project Scoping Meeting Attendance Sheet

EPA Regulation Program: RCRA FIFRA TSCA CERCLA DW CWA CAA **Program: Brownfields, NPDES, etc._____** **Projected Date(s) of Sampling_____** **Project Manager_____**	**Site Name_____** **Site Location_____** **CERCLA Site/Spill Identifier No. 01_____** **Operable Unit_____** **Other Site Number/Code_____** **Phase: ERA SA/SI pre-RI RI (phase I, etc.) FS RD RA post-RA (circle one)** **Other phase:_____**

Date of Meeting:
Meeting Location:

Name	Title	Affiliation	Phone #	Project Role

Meeting Purpose:_____

Comments:_____

OPTIONAL QAPP Worksheet #9a
Provide a brief overview of project activities, including contaminants of concern, sampling tasks, system designs, analytical tasks, data verification and validation tasks, quality control activities, quality assurance assessments, data usability assessments, and records and reports.
(Refer to *QAPP Manual* Section A.6.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Project Description

OPTIONAL QAPP Worksheet #9b
Complete separate tables for each medium/matrix, analytical parameter, and concentration level. List the analyte name and CAS numbers of all Contaminants of Concern (COCs) and other target analytes that will be measured for the project. Identify the COCs with an "*". Identify the Project Quantitation Limits required to meet project objectives, i.e., known regulatory or technical Project Action Limits for each analyte. List the MDLs and QLs of the published method and the MDLs and QLs achievable by the laboratory. Ensure that the achievable laboratory quantitation limits are less than or equal to the Project Quantitation Limits and that Project Quantitation Limits are at least two to five times less than the Project Action Limits. (Refer to *QAPP Manual* Section A.6.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Medium/Matrix:
Matrix Code (from OPTIONAL DQO Summary Form):
Analytical Parameter:
Concentration Level:
Field Analytical or Fixed Laboratory Method/SOP[1]:

Contaminants of Concern and Other Target Analytes Table (Reference Limit and Evaluation Table)

Analyte	CAS Number	Project Action Limit (Units) (wet or dry weight)	Project Quantitation Limit (Units) (wet or dry weight)	Analytical Method		Achievable Laboratory Limits	
				MDLs[1]	Method QLs[1]	MDLs[2]	QLs[2]

[1]Analytical method MDLs and QLs documented in validated methods. QLs are usually 3-10 times higher than the MDLs.
[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

OPTIONAL QAPP Worksheet #9c
Summarize by matrix the number of field and QC samples that will be collected for each analytical parameter and concentration level. (Refer to *QAPP Manual* Section A.6.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Field Quality Control Sample Summary Table

Medium/ Matrix	Analytical Parameter	Concentration Level	Analytical Method/ SOP Reference	No. of Sampling Locations[1]	No. of Field Duplicate Pairs	Organic		Inorganic		No. of VOA Trip Blanks	No. of Bottle Blanks	No. of Equip. Blanks	No. of Cooler Temp. Blanks	No. of PE Samples	Total No. of Samples to Lab
						No. of MS	No. of MSD	No. of Duplicates	No. of Spikes						

[1]**If samples will be collected at different depths at the same location, count each discrete sampling depth as a separate sampling location/station.**

OPTIONAL QAPP Worksheet #9d
Complete this worksheet for each medium/matrix, analytical parameter, and concentration level. Identify all laboratories/organizations that will provide analytical services for the project, including field screening, field analytical, and fixed laboratory analytical work. If applicable, identify the backup laboratory/organization that will be used if the primary laboratory/organization cannot be used. (Refer to *QAPP Manual* Sections A.6.1, B.2.1 and B.2.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Analytical Services Table

Medium/ Matrix	Analytical Parameter	Concentration Level	Analytical Method/SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address: Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address: Contact Person and Telephone Number)

OPTIONAL QAPP Worksheet #10
List project activities and anticipated start and completion dates. Identify all products and/or deliverables as outcomes of project activities and the anticipated dates of delivery. (Refer to *QAPP Manual* Section A.6.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Project Schedule Timeline Table

Activities	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
	Anticipated Date(s) of Initiation	Anticipated Date of Completion		

OPTIONAL QAPP Worksheet #11
Complete this worksheet for each medium/matrix, analytical parameter and concentration level. Identify the DQI, measurement performance criteria, and QC sample and/or activity used to assess the measurement performance for the sampling and/or analytical procedure. Use additional worksheets if necessary.
If MPC for a specific DQI vary within an analytical parameter, i.e., MPC are analyte-specific, then provide analyte-specific MPC on an additional worksheet. (Refer to *QAPP Manual* Sections A.7.1 and A.7.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Measurement Performance Criteria Table

Medium/Matrix	
Analytical Parameter	
Concentration Level	

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)[1]	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)

[1]**Data Quality Indicators (a.k.a. PARCC parameters, i.e., precision, accuracy/bias, sensitivity, data completeness, comparability)**

OPTIONAL QAPP Worksheet #12a
Describe the project sampling design. Provide the rationale for selecting sample locations and sampling each medium/matrix for each analytical parameter and concentration level. (Refer to *QAPP Manual* Section B.1.1.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Sampling Design and Rationale

OPTIONAL QAPP Worksheet #12b
List all site locations that will be sampled and include sample location ID number, if applicable. Specify medium/matrix and, if applicable, depth at which samples will be taken. Complete all required information, using additional worksheets if necessary. (Refer to *QAPP Manual* Section B.1.1.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page _____ of _____

Sampling Locations and Sampling and Analysis Method/SOP Requirements Table

Sampling Location[1,2]	Location ID Number	Medium/ Matrix	Depth (units)	Analytical Parameter	Concentration Level	Number of Samples (identify field duplicates and replicates)	Sampling SOP	Analytical Method/SOP	Sample Volume	Containers (number, size and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)

[1]**Indicate critical field sampling locations with "1".**
[2]**Indicate background sampling locations with "2".**

OPTIONAL QAPP Worksheet #13
List all SOPs associated with sample collection. Include copies of all written SOPs as attachments to the QAPP. Sequentially number sampling SOP references with an "S" prefix in the Reference Number column. Use additional pages if necessary. The Reference Number can be used throughout the QAPP to refer to a specific SOP.
(Refer to *QAPP Manual* Sections B.1.2.1-B.1.2.3 for guidance.)

Title:
Revision Number:
Revision Date:
Page _____ of _____

Project Sampling SOP Reference Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Identification	Modified for Project Work Y or N	Comments
S-1					
S-2					
S-3					
S-4					
S-5					
S-6					
S-7					
S-8					

OPTIONAL QAPP Worksheet #14
Identify all field equipment and procedures that require calibration and provide the SOP reference number and person responsible for corrective action for each type of equipment. If frequency of calibration, acceptance criteria, and corrective action information is not included in an SOP, then document this information on the worksheet. (Refer to *QAPP Manual* Section B.1.2.4 for guidance.)

Title:
Revision Number:
Revision Date:
Page_____ of _____

Field Sampling Equipment Calibration Table

Equipment	Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference*

*** Specify appropriate reference letter/number from the Project Sampling SOP Reference Table (see OPTIONAL QAPP Worksheet #13).**

OPTIONAL QAPP Worksheet #15
Identify all field equipment and instruments (include analytical instruments on Worksheet #19) that require maintenance and provide the SOP reference number and person responsible for corrective action for each type of equipment. If frequency of calibration, acceptance criteria, and corrective action information is not included in an SOP, then document this information on the worksheet. (Refer to *QAPP Manual* Section B.1.2.5 for guidance.)

Title:
Revision Number:
Revision Date:
Page_____ of _____

Field Equipment Maintenance, Testing, and Inspection Table

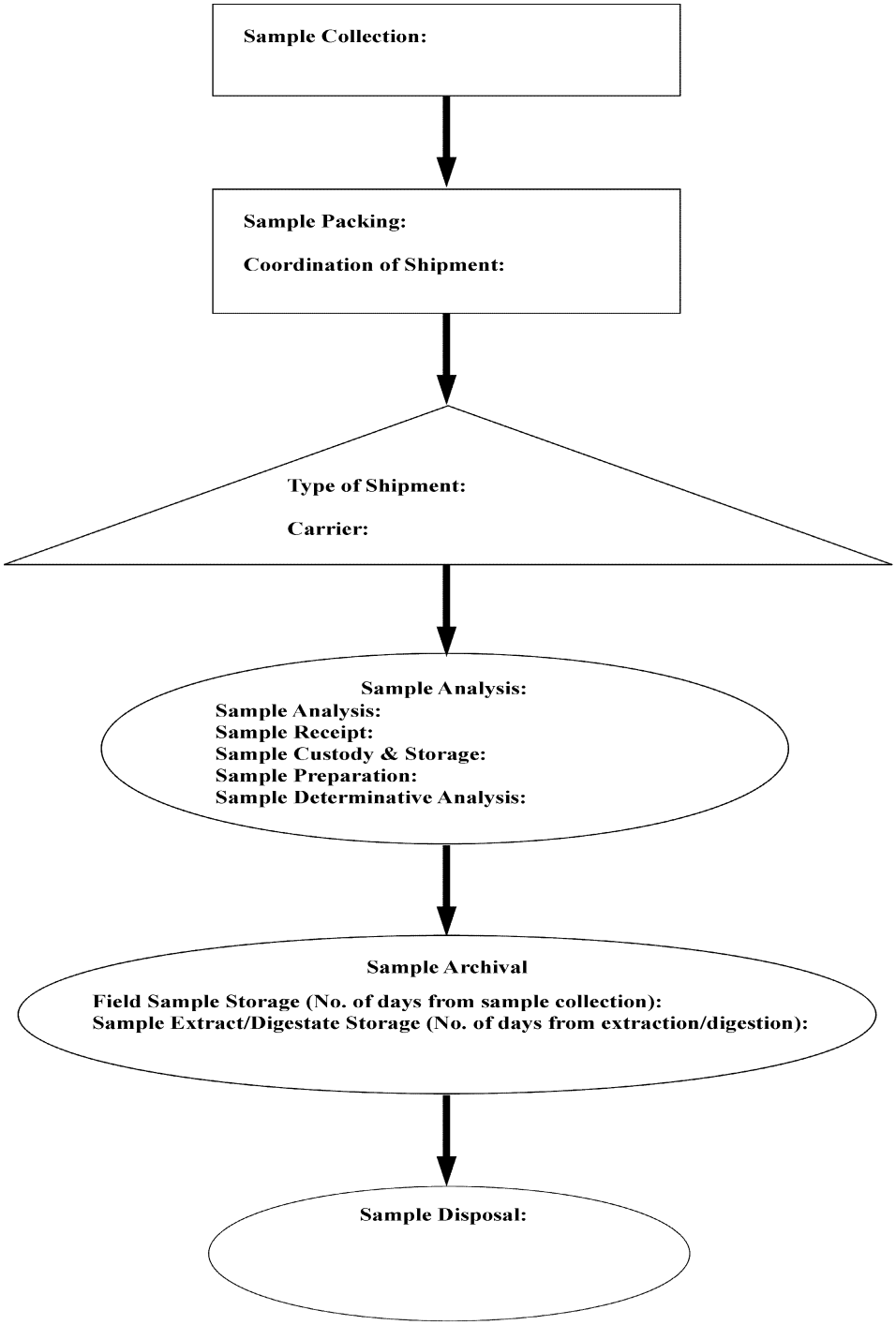
Sampling Equipment/ Instrument	Maintenance Activity	Testing Activity	Inspection Activity	Responsible Person	Frequency	Acceptance Criteria	Corrective Action	SOP Reference*

*** Specify appropriate reference letter/number from the Project Sampling SOP Reference Table (see OPTIONAL QAPP Worksheet #13).**

OPTIONAL QAPP Worksheet #16
Use this worksheet to develop a flow diagram describing the flow of samples. Record personnel, and their organizational affiliations, who are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection to laboratory delivery to final sample disposal. Indicate the number of days original field samples and their extracts/digestates will be archived prior to disposal. (Refer to *QAPP Manual* Section B.1.3.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page ___ of ___

Sample Handling Flow Diagram



99-138.04a

OPTIONAL QAPP Worksheet #17
List all methods/SOPs that will be used to perform field analysis either directly in the field or in a mobile field laboratory. Indicate whether the method/procedure produces screening or definitive data. Sequentially number field analytical method/SOP references with an "F" prefix in the Reference Number column. Use additional pages if necessary. Include copies of all methods/SOPs as attachments to the QAPP. The reference number can be used throughout the QAPP to refer to a specific method/SOP. (Refer to *QAPP Manual* Sections B.2.1.1 and B.2.1.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page_____ of _____

Field Analytical Method/SOP Reference Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Originating Organization	Analytical Parameter	Instrument	Organization Performing Field Analysis	Modified for Project Work Y or N
F-1							
F-2							
F-3							
F-4							
F-5							
F-6							

OPTIONAL QAPP Worksheet #18
Identify all field analytical instruments that require calibration and provide the required information for each. Use additional pages if necessary. If required information is included in an SOP, summarize relevant information on the worksheet and reference the appropriate SOP number. (Refer to *QAPP Manual* Section B.2.1.3 for guidance.)

Title:
Revision Number:
Revision Date:
Page_____ of _____

Field Analytical Instrument Calibration Table

Instrument	Activity	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference*

*** Specify appropriate reference letter/number from Field Analytical Method/SOP Reference Table (see OPTIONAL QAPP Worksheet #17).**

OPTIONAL QAPP Worksheet #19
Identify all field analytical instruments that require calibration and provide the required information for each. If required information is included in an SOP, summarize relevant information on the worksheet and reference the appropriate SOP number. (Refer to *QAPP Manual* Section B.2.1.4 for guidance.)

Title:
Revision Number:
Revision Date:
Page_____ of _____

Field Analytical Instrument/Equipment Maintenance, Testing, and Inspection Table

Instrument	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	Method/SOP Reference*

*** Specify appropriate reference letter/number from Field Analytical Method/SOP Reference Table (see OPTIONAL QAPP Worksheet #17).**

OPTIONAL QAPP Worksheet #20
List all methods/SOPs that will be used to perform analyses in fixed laboratories. Indicate whether method procedure produces definitive or screening data. Sequentially number fixed laboratory SOP references with an "L" prefix in the Reference Number column. Use additional pages if necessary. Include copies of all methods/SOPs as attachments to the QAPP or attach Laboratory QA Plans/Manuals for each laboratory that will provide analytical services and reference the appropriate sections in the project QAPP. The Reference Number can be used throughout the QAPP to refer to a specific method/SOP. (Refer to *QAPP Manual* Sections B.2.2.1 and B.2.2.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page_____ of _____

Fixed Laboratory Analytical Method/SOP Reference Table

Reference Number	Fixed Laboratory Performing Analysis	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Parameter	Instrument	Modified for Project Work Y or N
L-1						
L-2						
L-3						
L-4						
L-5						
L-6						
L-7						

OPTIONAL QAPP Worksheet #21
Identify all fixed laboratory analytical instruments that require calibration and provide the required information for each. Use additional pages if necessary. If required information is included in an SOP, summarize relevant information on the worksheet and reference the appropriate SOP number. (Refer to *QAPP Manual* Section B.2.2.3 for guidance.)

Title:
Revision Number:
Revision Date:
Page_____ of _____

Fixed Laboratory Instrument Maintenance and Calibration Table

Instrument	Activity	List Maintenance, Testing and Inspection Activities	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	Method/SOP Reference*

*** Specify appropriate reference letter/number from Fixed Laboratory Analytical Method/SOP Reference Table (see OPTIONAL QAPP Worksheet #20).**

OPTIONAL QAPP Worksheet #22a

Complete a separate worksheet for each sampling technique, medium/matrix, analytical parameter, and concentration level. If an analytical parameter has multiple analytes, list the overall field and analytical precision and accuracy/bias expected for each analyte when using the specified sampling and analytical technique. If method/SOP QC acceptance limits exceed the measurement performance criteria, then data may not meet user needs. (Refer to *QAPP Manual* Sections B.3.1 and B.3.1.1, and Table 4 for guidance.)

Title:
Revision Number:
Revision Date:
Page_____ of _____

Field Sampling QC Table

Sampling SOP*	
Medium/Matrix	
Analytical Parameter[1]	
Concentration Level	
Analytical Method/SOP Reference	
Sampler's Name	
Field Sampling Organization	
No. of Sample Locations	

Field QC:	Frequency/Number	Method/SOP QC Acceptance Limits[2]	Corrective Action (CA)	Person(s) Responsible for CA	Data Quality Indicator (DQI)	Measurement Performance Criteria[3]
Equipment Blanks/ Rinsate Blanks						
Bottle Blanks						
VOA Trip Blanks						
Cooler Temperature Blanks						
Field Duplicate Pairs						
Collocated Samples						
Field Splits						
PES sent to Laboratory						
Other:_____ _____						

OPTIONAL QAPP Worksheet #22b
Complete this worksheet when an analytical parameter has multiple analytes. Describe the overall precision and accuracy/bias acceptance criteria for the sampling and analytical technique for all COCs and other target analytes. Identify the COCs with an "*". Use additional worksheet pages if necessary. (Refer to *QAPP Manual* Sections B.3.1 and B.3.1.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Sampling SOP:
Analytical Method/SOP:

Field Sampling SOP Precision and Accuracy Table

Analyte	Field Precision	Field Accuracy/Bias (Contamination)

OPTIONAL QAPP Worksheet #23a

Complete a separate worksheet for each medium/matrix, analytical parameter, and concentration level. If method/SOP QC acceptance limits exceed the measurement performance criteria, then data may not meet user needs. (Refer to *QAPP Manual* Sections B.3.1 and B.3.1.2, and Tables 3 and 4 for guidance.)

Title:
Revision Number:
Revision Date:
Page____ of ____

Field Analytical QC Sample Table

Medium/Matrix	
Sampling SOP	
Analytical Parameter[1]	
Concentration Level	
Analytical Method/ SOP Reference*	
Field Analytical Organization	
No. of Sample Locations	

Laboratory QC:	**Frequency/Number**	**Method/SOP QC Acceptance Limits[2]**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria[3]**
Method Blank						
Reagent Blank						
Storage Blank						
Instrument Blank						
Laboratory Duplicate						
Laboratory Matrix Spike						
Matrix Spike Duplicates						
LCS						
LFB						
Surrogates						
Internal Standards (ISs)						
Other:_____						

OPTIONAL QAPP Worksheet #23b
Complete this worksheet when an analytical parameter has multiple analytes. Describe the overall precision and accuracy/bias acceptance criteria for the analytical method/ SOP for all COCs and other target analytes. Identify the COCs with an "*". Use additional worksheet pages if necessary. (Refer to *QAPP Manual* Sections B.3.1 and B.3.1.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page____ of ____

Sampling SOP:
Analytical Method/SOP:

Field Analytical Method/SOP Precision and Accuracy Table

Analyte	Achievable Sensitivity/ Quantitation Limits	Field Analytical Precision	Field Analytical Accuracy/Bias

OPTIONAL QAPP Worksheet #24a

Complete a separate worksheet for each medium/matrix, analytical parameter, and concentration level. If method/SOP QC acceptance limits[2] exceed the measurement performance criteria, then data may not meet user needs.
(Refer to *QAPP Manual* Sections B.3.1 and B.3.1.2, and Tables 3 and 4 for guidance.)

Title:
Revision Number:
Revision Date:
Page____ of ____

Fixed Laboratory Analytical QC Sample Table

Medium/Matrix	
Sampling SOP	
Analytical Parameter	
Concentration Level	
Analytical Method/ SOP Reference	
Laboratory Name	
No. of Sample Locations	

Laboratory QC:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**Corrective Action (CA)**	**Person(s) Responsible for CA**	**Data Quality Indicator (DQI)**	**Measurement Performance Criteria**
Method Blank						
Reagent Blank						
Storage Blank						
Instrument Blank						
Laboratory Duplicate						
Laboratory Matrix Spike						
Matrix Spike Duplicates						
LCS						
LFB						
Surrogates						
Internal Standards (ISs)						
Other:_____ _____						

OPTIONAL QAPP Worksheet #24b
Complete this worksheet when an analytical parameter has multiple analytes. Describe the overall precision and accuracy/bias acceptance criteria for the analytical method/ SOP for all COCs and other target analytes. Identify the COCs with an "*". Use additional worksheet pages if necessary. (Refer to *QAPP Manual* Sections B.3.1 and B.3.1.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page____ of ____

Sampling SOP:
Analytical Method/SOP:

Fixed Laboratory Method/SOP Precision and Accuracy Table

Analyte	Achievable Laboratory Sensitivity/ Quantitation Limits	Analytical Precision	Analytical Accuracy/Bias

OPTIONAL QAPP Worksheet #25
Identify information and/or data generated/collected outside of the current data collection activity that will be used to make environmental decisions for the project. Specify how those acquired data/information will be used and the limitations on their use. These limitations include data quality considerations/problems as well as documentation completeness. (Refer to *QAPP Manual* Section B.4.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Non-Direct Measurements Criteria and Limitations Table

Non-Direct Measurement (Secondary Data)	Data Source (Originating Organization, Report Title and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use

OPTIONAL QAPP Worksheet #26
Identify the documents and records that will be generated for all aspects of the project. (Refer to *QAPP Manual* Section B.5.1.1 for guidance.)

Title:
Revision Number:
Revision Date:
Page____ of ____

Project Documents and Records Table

Sample Collection Records	Field Analysis Records	Fixed Laboratory Records	Data Assessment Records	Other _____

OPTIONAL QAPP Worksheet #27a
Describe procedures for identifying and correcting any problems encountered during the project.
(Refer to *QAPP Manual* Sections C.1-C.1.3 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Assessment and Response Actions

OPTIONAL QAPP Worksheet #27b
Identify the frequency, number and type of planned assessment activities that will be performed for the project. (Refer to *QAPP Manual* Sections C.1-C.1.3 for guidance.)

Title:
Revision Number:
Revision Date:
Page____ of ____

Project Assessment Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment, Title and Organizational Affiliation	Person(s) Responsible for Responding to Assessment Findings, Title and Organizational Affiliation	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA), Title and Organizational Affiliation	Person(s) Responsible for Monitoring Effectiveness of CA, Title and Organizational Affiliation

OPTIONAL QAPP Worksheet #28
Identify the frequency and type of planned QA Management Reports, the projected delivery date, the personnel responsible for report preparation, and the report recipients. (Refer to *QAPP Manual* Section C.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page____ of ____

QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation, Title, and Organizational Affiliation	Report Recipients, Title, and Organizational Affiliation

OPTIONAL QAPP Worksheet #29a
Describe the process for the collection, organization, and verification/validation of all information collected and generated throughout an environmental project. Include in the description how the results will be conveyed to the data user. Indicate, in the appropriate column, if the process is performed internally (I) or externally (E) to the data generator, and indicate who will be responsible for performing the task. (Refer to *QAPP Manual* Section D.1.1 and D.1.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page ___ of ___

Figure 29a. Example: Data Verification/Validation Process Table

Verification/ Validation Task	Description	I/E	Responsible for Verification/ Validation (Name, Organization)

OPTIONAL QAPP Worksheet #29b
List the criteria and data verifier/validator ultimately responsible for validation (by title and organizational affiliation) for each matrix, analytical parameter, and concentration level. (Refer to *QAPP Manual* Sections D.1.1 and D.1.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page ___ of ___

Figure 29b. Example: Data Verification/Validation Summary Table

Medium/ Matrix	Analytical Parameter	Concentration Level	Verification/Validation Criteria	Data Verificator/Validator (Title and organizational affiliation)	Responsibility for Data Verification/Validation (Title and organizational affiliation)

OPTIONAL QAPP Worksheet #30

Describe the scientific and statistical procedures/methods (not just definitions of DQIs) that will be used to determine whether data are of the right type, quality and quantity to support environmental decision-making for the project. Specifically describe how precision, accuracy/bias, representativeness, sensitivity (i.e., achievement of project Quantitation Limits), completeness and comparability data will be used to determine if project quality objectives were achieved. Describe how data quality issues will be addressed, and how limitations on the use of the data will be handled. (Refer to *QAPP Manual* Sections A.7 and D.2 for guidance.)

Title:
Revision Number:
Revision Date:
Page ____ of ____

Data Usability Assessment

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Appendix 2

QAPP Summary Form

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A separate Form should be completed for each sampling event. Refer to Attachment A for instructions on completing this form, Attachment B for a complete list of the parameter codes and Attachment C for an example of a completed form.

1. EPA Program: TSCA CERCLA RCRA DW NPDES CAA
Other:_____
Projected Date(s) of Sampling_____
Site Manager_____
Case Team Members_____
_____
_____

Site Name_____
Site Location_____
Assigned Site Latitude/Longitude_____
CERCLA Site/Spill Identifier No. 01 _____ _____(Include Operable Unit)
Phase: ERA SA/SI pre-RI RI (phase I, etc.) FS RD RA post-RA
(circle one) Other:_____

2. QAPP Title and Revision Date_____
_____
Approved by:_____ Date of Approval:_____
Title of Approving Official:_____ Organization*:_____
*If other than EPA, record date approval authority was delegated:_____

EPA Oversight Project (circle one) Y N Type of EPA Oversight (circle one) PRP or FF
Other:_____
Confirmatory Analysis for Field Screening Y N If EPA Oversight or Confirmatory: % splits_____
Are comparability criteria documented? Y N

3.									
a.	Matrix Code[1]								
b.	Parameter Code[2]								
c.	Preservation Code[3]								
d.	Analytical Services Mechanism								
e.	No. of Sample Locations								
	Field QC:								
f.	Field Duplicate Pairs								
g.	Equipment Blanks								
h.	VOA Trip Blanks								
i.	Cooler Temperature Blanks								
j.	Bottle Blanks								
k.	Other:_____ _____								
l.	PES sent to Laboratory								
	Laboratory QC:								
m.	Reagent Blank								
n.	Duplicate								
o.	Matrix Spike								
p.	Matrix Spike Duplicate								
	LCS								
	Duplicate Sample								
	ICP Serial Dilution								
	ICP Interference Check								
q.	Other:_____ _____								

4. Site Information
Site Dimensions_____
List all potentially contaminated matrices_____
Range of Depth to Groundwater_____
Soil Types: Surface Subsurface Other:_____
Sediment Types: Stream Pond Estuary Wetland Other:_____ Expected Soil/Sediment Moisture Content: High Low

When multiple matrices will be sampled during a sampling event, complete Sections 5-10 for each matrix. Matrix Code[1]_____

5. Data Use (circle all that apply) Site Investigation/Assessment PRP Determination Removal Actions
Nature and Extent of Contamination Human and/or Ecological Risk Assessment Remediation Alternatives
Engineering Design Remedial Action
Post-Remedial Action (quarterly monitoring) Other:_____

6. Summarize DQOs:_____

Complete Table if applicable

COCs	Action Levels	Analytical Method-Quantitation Limits

7. Sampling Method (circle technique) Bailer Low flow pump: Yes No Peristaltic Pump
Positive Displacement Pump Faucet or Spigot Other:_____
Split Spoon Dredge Trowel Other:_____

Sampling Procedures (SOP name, No., Rev. #, and date)_____
List Background Sample Locations_____
Circle: Grab or Composite
"Hot spots" sampled: Yes No

8. Field Data (circle) ORP pH Specific Conductance Dissolved O_2 Temperature Turbidity

Other:_____

9. Analytical Methods and Parameters

Method title/SOP name	Method/SOP Identification number	Revision Date	Target Parameters (VOA, SV, Pest/PCB, Metals, etc.)

10. Validation Criteria (circle one) Validation Criteria:_____
Company/Organization Performing Data Validation_____Prime or Subcontractor (circle one)

11. Company Name_____Contract Number_____
Contract Name (e.g. START, RACS, etc.)_____Work Assignment No._____
Person Completing Form/Title_____Date of QAPP Summary Form Completion_____

Matrix Codes[1] - Refer to Attachment B, Part I
Parameter Codes[2] - Refer to Attachment B, Part II

Preservation Codes[3]

1. HCl to pH # 2
2. HNO_3
3. $NaHSO_4$
4. H_2SO_4
5. Cool @ 4EC (± 2E)
6. NaOH
7. $K_2Cr_2O_7$
8. Freeze
9. Room Temperature (avoid excessive heat)
10. Other (Specify)

N. Not preserved

* - To supplement Matrix Codes and/or Parameter Codes contact the QA Unit

ATTACHMENT A

Guidance for Completion of QAPP Summary Form

INSTRUCTIONS:

Note: A separate QAPP Summary Form can be completed for each sampling event. For sampling events involving multiple environmental matrices, complete Sections 5-10 for each matrix and ensure that the two-letter matrix code is identified in Section 5. Enter the page number and total number of pages in the top right hand corner on the Form.

Section 1:

- Circle the appropriate Program(s) involved in multi-media, multi-programmatic sampling events including, TSCA, CERCLA (i.e, Superfund), RCRA, DW (Drinking Water), NPDES, CAA (Clean Air), or fill in the blank for "Other:_____".
- List projected date(s) of sampling. The sampling dates should be inclusive of all matrices that will be sampled during this sampling event.
- Record the Site Manager's name.
- List the names of the other Project Team Members.
- Enter the site name.
- Record the name of the city/town and State where the site is located in the "Site Location" field.
- Record the "Assigned Site Latitude/Longitude".
- Record the CERCLA site/spill identifier number, if applicable, including the operable unit number. Contact the EPA Site Manager to obtain the correct identifier numbers.
- Circle the appropriate phase of site work (ERA: Environmental Risk Assessment, SA/SI: Site Assessment/Site Investigation, RI: Remedial Investigation, FS: Feasibility Study, RD: Remedial Design, RA: Remedial Assessment, post-RA: post-Remedial Assessment, i.e., quarterly monitoring).

Section 2:

- Record the complete title of the final QAPP and revision date.
- Enter name of the Approving Official.
- Record date that the QAPP was approved.
- Enter title of the Approving Official.
- Enter name of organization that has approval authority. This will be EPA, unless approval authority has been delegated by EPA to a State or other Federal Agency.
- If another organization has been delegated approval authority, then enter the date that EPA delegated approval authority (date of Quality Assurance Management Plan approval).
- Identify whether the project sampling event is an EPA oversight project, circle Yes or No.
- Indicate type of oversight by circling either Potentially Responsible Party (PRP) or Federal Facility (FF), or complete the blank for "Other:_____".
- Identify whether confirmatory sampling and analysis is being performed to verify field screening results, circle Yes or No.
- If EPA oversight or confirmatory analysis will be performed, record the percentage of split samples to be collected and analyzed.
- If EPA oversight or confirmatory analysis will be performed, identify whether comparability criteria are documented in the approved QAPP or SAP, circle Yes or No.

Section 3:

a) List the two letter code for each matrix for samples that will be collected. Refer to Appendix B for a correct list of matrix codes. If a matrix does not have a corresponding code, then attach a description of the matrix to the QAPP Summary Form.
b) For each matrix, identify the analytical parameters for samples that will be collected by recording the appropriate parameter code. Refer to Appendix B for a current list of parameter codes. If an analytical parameter does not have a corresponding code, then the method title and/or SOP name, method and/or SOP identification number, and method and/or SOP revision date should be included and recorded in Section 9 of this Form.
c) For each matrix and parameter, identify the preservation technique that will be used by recording the appropriate preservation code. Refer to the reverse side of this Form for a list of preservation codes.
d) Record the analytical service(s) mechanism that will be used for each matrix and parameter;
e) Record the number of discrete locations that will be sampled for each parameter. The "No. of Sample Locations" count should include the site and background locations sampled.

- Record the number of each type of field QC sample that will be collected and sent to the laboratory for analysis for each matrix and parameter.

f) Record the number of Field duplicate sample pairs (which will equal "1" for each pair of field duplicates) that will be collected.
g) Enter the number of equipment/rinsate blanks.
h) Enter the number of VOA Trip blanks.
i) Enter the number of Cooler Temperature blanks that will be used.
j) Enter the number of Bottle Blanks that will be analyzed.
k) Describe any other field QC samples and the total number that were collected and that will be sent to the laboratory.
l) Enter the number of PESs that will be sent to the laboratory.

- Record the number of each type of laboratory QC sample that will be analyzed with the samples received.

m) Enter the minimum number of reagent blanks that will be analyzed.
n) Enter the number of laboratory Duplicates that will be analyzed.
o) Enter the number of matrix spikes that will be analyzed.
p) Enter the number of matrix spike duplicates that will be analyzed.
p1) Enter the number of LCS samples.
p2) Enter the number of duplicate samples.
p3) Enter the number of ICP serial dilutions.
p4) Enter the number of ICP interference check samples.
q) Describe any other laboratory QC samples and the total number that will be analyzed.

Section 4:

- Enter the approximate site dimensions with units.
- List all potentially contaminated matrices, regardless of whether or not they will be sampled during this sampling event.
- For well sampling, complete "Range of Depth to Groundwater" to ensure proper pump is utilized.
- For soil sampling, circle Surface or Subsurface or complete Other:_____.
- For sediment sampling, circle Stream, Pond, Estuary, Wetland, or complete Other:_____.
- For soil/sediment sampling, circle expected moisture content: High or Low. **Note: Analytical methods used for high moisture content samples should ensure that DQO-specified dry weight quantitation limits are achieved.**

Section 5:

When multiple matrices will be sampled during a sampling event, complete Sections 5-10 for each matrix and enter the Matrix Code.

- Identify the two-letter matrix code for which the information is provided in sections 5-10.
- Circle the potential uses for sample data such as, site investigation/assessment, PRP determination, removal actions, nature and extent of contamination, human and/or ecological risk assessment, remediation alternatives, engineering design, remedial action, post-remedial action, i.e., quarterly monitoring. A space is available for other potential uses of data.

Section 6:

- Briefly summarize the project DQOs. This section should describe the specific objectives of the sampling event, i.e., to identify health risks to children, ages 1-6, residing on the site who might be exposed to surface soils located in the area, or to characterize the extent of groundwater contamination. Identify the purpose of sampling, the decisions that will be made using the data, action level information, and any related information needed to identify that appropriate analytical and field sampling methods were chosen. Complete the table with the following information: contaminants of concern (COC), COC action levels and analytical method quantitation limits for each COC. **Note: Since this information will be used by data validators to identify potential data usability issues for the user, it is imperative that it is clear and concise.**

Section 7:

- Circle applicable sampling technique(s) used and/or complete "Other" to describe an innovative sampling technique or one that is not listed.
- Identify the SOPs that will be utilized for sample collection. Include SOP name, identification number and revision number and/or date.
- Record the discrete Background sample station location number(s) that will be sampled.
- Circle if samples will be "grab" or "composite".
- To indicate potential "Hot spots" on site, circle Yes or No.

Section 8:

- Identify the field data that will be collected including, ORP, pH, specific conductance, dissolved O_2, temperature, and turbidity. A space is available to indicate other field testing that will be performed.

Section 9:

- If an analytical method does not have a Parameter code (required information in Section 3), then the method title and/or SOP name, method and/or SOP identification number, and method and/or SOP revision date should be included. Attach a separate page if additional space is needed.
- Record the specific parameters required for analysis.

Section 10:

- Circle the data validation criteria required by the QAPP and/or SAP.
- Circle the Validation Tier that will be used.
- Identify the company performing the data validation. Circle either Prime or Subcontractor.

Section 11:

- Record the field sampling contractor company/organization name
- Contract number
- Name of contract
- Work assignment number
- Name and title of person completing Form
- Completion date of the QAPP Summary Form

ATTACHMENT B - PART I

Matrix Codes[1]

Aqueous:
DW - Drinking Water
GW - Ground Water
LE - Leachate (includes porewater)
SW - Surface Water
WW - Waste Water (includes scrubber blowdown)

Solid:
SE - Sediment (includes tidal sediments)
SO - Soil

Biota:
BD - Bird Tissue
CF - Crawfish Tissue
FI - Fish (includes whole fish)
MU - Mussel (includes clam, quahog, and oyster tissue)
OF - Offal
PL - Plant
FF - Fish Fillet

Wastes:
AS - Ash (includes incinerator ash and boiler aggregate)
DU - Dust (includes concrete dust and fines)
OI - Oil (includes waste oil)
SL - Sludge
WD - Wood (includes chips, cuttings, and drillings)
WT - Waste (includes both solids and liquids)
ST - Still Bottoms

Miscellaneous:
AR - Air Samples
DN - DNAPLs
LN - LNAPLs
WI - Wipe Samples
PC - Paint Chips
CT - Concrete

PARAMETER CODE/METHOD IDENTIFICATION NUMBER	METHOD TITLE	REFERENCE	PARAMETER NAME
OLM03.1F	USEPA CLP Statement of Work for Organics Analysis - OLM03.1	1	Full organics (VOA, SV, P/P) CLP SOW Organic Analysis
OLM03.1P	USEPA CLP Statement of Work for Organics Analysis - OLM03.1	1	Pesticide/Aroclors Analysis CLP SOW Organic Analysis
OLM03.1S	USEPA CLP Statement of Work for Organics Analysis - OLM03.1	1	Semivolatile Organics Analysis CLP SOW Organic Analysis
OLM03.1V	USEPA CLP Statement of Work for Organics Analysis - OLM03.1	1	Volatile Organics Analysis CLP SOW Organic Analysis
1003	Halogenated Hydrocarbons	2	NIOSH 1003 Volatile on Charcoal Tubes
12/90-DI	USEPA CLP Statement of Work for Analysis of Polychlorinated Dibenzo-p-Dioxins (PCDD) and Polychlorinated Dibenzofurans (PCDF), DFLM1.0, Rev. 12/90	3	12/90 SOW Dioxin/Furan Analysis
130.1	Hardness, Total (mg/L) as $CaCO_3$, Colorimetric, Automated EDTA	4	Hardness-Colorimetric, Automated EDTA
130.2	Hardness, Total (mg/L) as $CaCO_3$, Titrimetric, EDTA	4	Hardness-Titrimetric, EDTA
13112007	Toxicity Characteristic Leaching Procedure and Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Atomic Emission Spectrometry	5 & 7	TCLP Extraction-Metals Analysis
13113.1F	Toxicity Characteristic Leaching Procedure and USEPA CLP Statement of Work for Organics Analysis - OLM03.1	5 & 1	TCLP Extraction-Full Organics Volatile, Semivolatile, Pesticide/PCB Analysis
13113.1P	Toxicity Characteristic Leaching Procedure and USEPA CLP Statement of Work for Organics Analysis - OLM03.1	5 & 1	TCLP Extraction-Pesticide/PCB Analysis
13113.1S	Toxicity Characteristic Leaching Procedure and USEPA CLP Statement of Work for Organics Analysis - OLM03.1	5 & 1	TCLP Extraction-Semivolatile Analysis
13113.1V	Toxicity Characteristic Leaching Procedure and USEPA CLP Statement of Work for Organics Analysis - OLM03.1	5 & 1	TCLP Extraction-Volatile Analysis
13118000	Toxicity Characteristic Leaching Procedure and Determination of Organic Analytes by Gas Chromatography	5	TCLP Extraction-Full Organics
13118080	Toxicity Characteristic Leaching Procedure and Determination of Organochlorine Pesticides and PCBs by Gas Chromatography	5	TCLP Extraction-Pesticide/PCB Analysis
13118240	Toxicity Characteristic Leaching Procedure and Determination of Volatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS)	5	TCLP Extraction-Volatile Analysis
13118270	Toxicity Characteristic Leaching Procedure and Determination of Semivolatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique	5	TCLP Extraction-Semivolatile Analysis
160.1	Residue, Filterable, Gravimetric, Dried at 180 EC	4	Total Dissolved Solids (TDS)
160.2	Residue, Non-filterable, Gravimetric, Dried at 103-105 EC	4	Total Suspended Solids (TSS)
160.3	Residue, Total, Gravimetric, Dried at 103-105 EC	4	Total Solids
1613	Tetra- through Octa- Chlorinated Dioxins and Furans by Isotope Dilutions HRGC/HRMS	6	Dioxin/Furan High Resolution Analysis
200.7	Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma - Atomic Emission Spectrometry (Rev.4.4, 1994)	7	ICP Metals Analysis-Full List

PARAMETER CODE/METHOD IDENTIFICATION NUMBER	METHOD TITLE	REFERENCE	PARAMETER NAME
200.7XX	Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma - Atomic Emission Spectrometry (Rev.4.4, 1994)	7	ICP Metals Analysis-XX Specific Metals
200.9/CD	Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption Spectrometry (Rev. 2.2, 1994)	7	Graphite Furnace-Cadmium
200.9/SB	Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption Spectrometry	7	Graphite Furnace-Antimony
200.9AS	Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption Spectrometry	7	Graphite Furnace-Arsenic
204.2/SB	Antimony AA, Furnace	4	Graphite Furnace-Antimony
206.2	Arsenic AA, Furnace	4	Graphite Furnace-Arsenic
213.2/CD	Cadmium AA, Furnace	4	Graphite Furnace-Cadmium
2320.B	Alkalinity, Titration Method	8	Titration Method-Alkalinity
2340B	Hardness by Calculation	8	Hardness-Calculation
2340C	Hardness, EDTA Titrimetric Method	8	Hardness Titrimetric, EDTA
2540B	Total Solids Dried at 103-105 EC	8	Total Solids
2540C	Total Dissolved Solids Dried at 180 EC	8	Total Dissolved Solids (TDS)
2540D	Total Suspended Solids Dried at 103-105 EC	8	Total Suspended Solids (TSS)
300.0C1	Ion Chromatography		Determination Inorganic Anions in AQ by IC
300.0F	Ion Chromatography		Ion Chrom.-Fluoride
300.0N03	Ion Chromatography		Ion Chrom.-Nitrate
310.1	Alkalinity Titrimetric (pH 4.5)	4	Titrimetric Alkalinity
310.2	Alkalinity, Colorimetric, Automated, Methyl Orange	4	Colorimetric-Alkalinity
3113B/AS	Metals by Electrothermal Atomic Absorption Spectrometry	8	Graphite Furnace-Arsenic
3113B/CD	Metals by Electrothermal Atomic Absorption Spectrometry	8	Graphite Furnace-Cadmium
3113B/SB	Metals by Electrothermal Atomic Absorption Spectrometry	8	Graphite Furnace-Antimony
325.2	Chloride, Colorimetric, Automated Ferricyanide AA II	4	Colorimetric-Chloride
325.3	Chloride, Titrimetric, Mercuric Nitrate	4	Titrimetric-Chloride
335.2	Cyanide, Total, Titrimetric; Spectrophotometric	4	Titrimetric-Total Cyanide
340.2	Fluoride, Potentiometric, Ion Selective Electrode	4	Electrode-Fluoride
350.1	Nitrogen, Ammonia, Colorimetric, Automated Phenate	4	Colorimetric-Ammonia
350.2	Nitrogen, Ammonia, Colorimetric; Titrimetric; Potentiometric-Distillation Procedure	4	Colorimetric, Titrimetric, Electrode-Dist.-Ammonia

PARAMETER CODE/METHOD IDENTIFICATION NUMBER	METHOD TITLE	REFERENCE	PARAMETER NAME
350.3	Nitrogen, Ammonia, Potentiometric, Ion Selective Electrode	4	Electrode-Ammonia
351.2	Nitrogen, Kjeldahl, Total, Colorimetric, Semi-Automated Block Digester, AA II	4	Colorimetric Semi-Auto-Total Kjeldahl N (TKN)
351.3	Nitrogen, Kjeldahl, Total, Colorimetric; Titrimetric; Potentiometric	4	Colorimetric, Titrimetric, Electrode-Total Kjeldahl N (TKN)
352.1	Nitrogen, Nitrate, Colorimetric, Brucine	4	Colorimetric-Nitrate
353.1	Nitrogen, Nitrate-Nitrite, Colorimetric, Automated, Hydrazine Reduction	4	Colorimetric, Auto., Hydr-Red.-Nitrate
353.2	Nitrogen, Nitrate-Nitrite, Colorimetric, Automated, Cadmium Reduction	4	Colorimetric, Auto., Cd-Red.-Nitrate
353.3	Nitrogen, Nitrate-Nitrite, Spectrophotometric, Cadmium Reduction	4	Spectro., Cd-Red-Nitrate
354.1	Nitrogen, Nitrite, Spectrophotometric	4	Spectrophotometric-Nitrite
365.1	Phosphorus, All Forms, Colorimetric, Automated, Ascorbic Acid	4	Colorimetric, Auto, Ascorbic Acid-Phosphorus
365.2	Phosphorus, All Forms, Colorimetric, Ascorbic Acid, Single Reagent	4	Colorimetric, Ascorbic Acid, 1 Reag-Phosphorus
365.3	Phosphorus, All Forms, Colorimetric, Ascorbic Acid, Two Reagent	4	Colorimetric, Ascorbic Acid, 2 Reag-Phosphorus
365.4	Phosphorus, Total, Colorimetric, Automated, Block Digestor AA II	4	Colorimetric, Auto.-Phosphorus
370.1	Silica, Dissolved, Colorimetric	4	Colorimetric-Silica
375.1	Sulfate, Colorimetric, Automated, Chloranilate	4	Colorimetric, Automated-Sulfate
375.3	Sulfate, Gravimetric	4	Gravimetric-Sulfate
375.4	Sulfate, Turbidimetric	4	Turbidimetric-Sulfate
376.1	Sulfide, Titrimetric, Iodine	4	Titrimetric-Sulfide
376.2	Sulfide, Colorimetric, Methylene Blue	4	Colorimetric-Sulfide
403	Bicarbonate		Bicarbonate
405.1	Biochemical Oxygen Demand BOD (5 day, 20EC)	4	5 Days 20EC -BOD
410.1	Chemical Oxygen Demand, Titrimetric, Mid-Level	4	Titrimetric-COD Mid. Level
410.2	Chemical Oxygen Demand, Titrimetric, Low Level	4	Titrimetric-COD Low Level
410.3	Chemical Oxygen Demand, Titrimetric, High Level for Saline Waters	4	Titrimetric-COD High Level
410.4	Chemical Oxygen Demand, Colorimetric, Automated; Manual	4	Spectrophotometric-COD Manual/Auto
4110	Determination of Anions by Ion Chromatography	8	Anions
413.1	Oil and Grease, Total Recoverable, Gravimetric, Separatory Funnel Extraction	4	Gravimetric-Oil & Grease
413.2	Oil and Grease, Total Recoverable, Spectrophotometric, Infrared	4	Oil and Grease (O & G) - IR Spec.
415.1	Organic Carbon, Total, Combustion or Oxidation	4	Combustion or Oxidation-TOC
415.2	Organic Carbon, Total, UV Promoted, Persulfate Oxidation		TOC-Low Level, UV Promoted

PARAMETER CODE/METHOD IDENTIFICATION NUMBER	METHOD TITLE	REFERENCE	PARAMETER NAME
418.1	Petroleum Hydrocarbons, Total Recoverable, Spectrophotometric, Infrared	4	IR Spec-TPH, Petroleum Hydrocarbons
418.1TPH	Petroleum Hydrocarbons, Total Recoverable, Spectrophotometric, Infrared	4	Total Petroleum Hydrocarbons
4500-P/E	Phosphorus, Ascorbic Acid Method	8	Ascorbic Acid-Phosphorus
4500-P/F	Phosphorus, Automated Ascorbic Acid Reduction Method	8	Auto. Ascorbic Acid-Phosphorus
4500F/C	Fluoride, Ion-Selective Electrode Method	8	Electrode-Fluoride
4500NO2B	Nitrogen (Nitrite) Colorimetric Method	8	Colorimetric-Nitrite
4500NO3E	Nitrogen (Nitrate) Cadmium Reduction Method	8	Cadmium Red. Manual-Nitrate
4500NO3F	Nitrogen (Nitrate) Automated Reduction Method	8	Cadmium Red. Auto.-Nitrate
4500NO3H	Nitrogen (Nitrate) Automated Hydrazine Reduction	8	Automated Hydrazine-Nitrate
4500S/D	Sulfide, Methylene Blue Method	8	Methylene Blue Sulfide
4500S/F	Sulfide, Iodometric Method	8	Iodometric-Sulfide
4500S04C	Sulfate, Gravimetric Method with Ignition of Residue	8	Grav.+Ignition-Sulfate
4500S04D	Sulfate, Gravimetric Method with Drying of Residue	8	Grav.+Drying-Sulfate
4500SI/D	Silica, Molybdosilicate Method	8	Molybdosilicate-Silica
504.1	1,2-Dibromethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (123 TCP) in Water by Microextraction and Gas Chromatography (Rev. 1.1, 1995)	9	EDB, DBCP & 123TCP, Microextraction & GC
5210/B	Biochemical Oxygen Demand (BOD), 5 Day BOD Test	8	5 Day-BOD
5220/C	Chemical Oxygen Demand (COD), Closed Reflux, Titrimetric Method	8	Titrimetric-COD Mid Level
5220/D	Chemical Oxygen Demand (COD), Closed Reflux, Colorimetric Method	8	Spectrophotometric-COD Manual/Auto
524.2	Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry (Rev. 4.0, 1992)	9	Measurement of Purgeable Organic Compounds in Water - Capillary Column by GC/MS
524.2+	Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry (Rev. 4.0, 1992)	9	524.2 Plus Additional Compounds
525.2	Determination of Organic Compounds in Drinking Water by Liquid-Solid Extraction and Capillary Column Gas Chromatography/Mass Spectrometry (Rev. 2.0, 1995)	9	Determination of Organic Compounds in DW by Liquid Solid Extraction Capillary Column by GC/MS
5310/B	Total Organic Carbon (TOC) Combustion-Infrared Method	8	Combustion-Infrared-TOC
5310/C	Total Organic Carbon (TOC) Persulfate-Ultraviolet Oxidation Method	8	Persulfate-UV Oxidation-TOC
5310/D	Total Organic Carbon (TOC) Wet-Oxidation Method	8	Wet-Oxidation-TOC
551.1	Detection of Chlorination Disinfection Byproducts and Chlorinated Solvents, and Halogenated Pesticides/Herbicides in Drinking Water by Liquid/Liquid Extraction and Gas Chromatography with Electron-Capture Detection	9	Det. Chloro. Disin. Byprods, Chloro Solv. by LL&GC

PARAMETER CODE/METHOD IDENTIFICATION NUMBER	METHOD TITLE	REFERENCE	PARAMETER NAME
5520/B	Oil and Grease Partition-Gravimetric Method	8	Gravimetric-Oil & Grease
5520/C&F	Oil and Grease Partition-Infrared Method and Hydrocarbons	8	IR Spec-TPH, Petroleum, Hydrocarbon
601	Purgeable Halocarbons (Trap-GC/Hall Detector-Electrolytic Conductivity Detector)	10	Purgeable Halocarbons Trap-GC/ELCD
602	Purgeable Aromatics (Trap-GC/PID)	10	Purgeable Aromatics Trap-GC/PID
608	Organochlorine Pesticides and PCBs by (GC/ECD)	10	Organochlorine Pest PCB-GC/ECD
624	Purgeables (Trap-GC/MS)	10	Purgeable Trap-GC/MS
625	Base/Neutrals and Acids (GC/MS)	10	Base/Neutrals&Acids Extr. GC/MS
8015A	Nonhalogenated Volatile Organics by Gas Chromatography	5	Nonhalogenated Volatile Org GC
8080A	Organochlorine Pesticides and Polychlorinated Biphenyls by Gas Chromatography (Rev. 1, 1994)	5	Organochlorine Pest.&PCB by GC/ECD
8240B	Volatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) (Rev.2, 1994)	5	Volatile Organic Compounds by GC/MS
8270B	Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique (Rev. 2, 1994)	5	Semivolatile Organic Compounds by GC/MS
8290	Polychlorinated Dibenzodioxins (PCDDs) and Polychlorinated Dibenzofurans (PCDFs) by High-Resolution Gas Chromatography/High - Resolution Mass Spectrometry (HRGC/HRMS) (Rev.0, 1994)	5	PCDDS & PCDFS by HRGC/MS
ASTM2974	Standard Test Method for Moisture, Ash and Organic Matter of Peat and Other Organic Matter	11	TCOC - TOT Combustible Org Content
ASTMD422	Standard Test Method for Particle-Size Analysis of Soils	11	Grain Size Analysis
ILM040CN	USEPA CLP SOW for Inorganics Analysis - ILM04.0	12	Cyanide Inorganic CLP SOW
ILM040MT	USEPA CLP SOW for Inorganics Analysis - ILM04.0	12	Metals (no CN) Inorganic CLP SOW
ILM040TL	USEPA CLP SOW for Inorganics Analysis - ILM04.0	12	Metals & Cyanide Inorganic CLP SOW
TO-1	Determination of Volatile Organic Compounds in Ambient Air using Tenax Adsorption and GC/MS	13	VOC-AIR, Tenax Tubes

PARAMETER CODE/METHOD IDENTIFICATION NUMBER	METHOD TITLE	REFERENCE	PARAMETER NAME
TO-14	Determination of Volatile Organic Compounds in Ambient Air Using Summa Passivated Canister Sampling and GC Analysis	13	VOC-AIR, Summa Canisters
TO-2	Determination of Volatile Organic compounds in Ambient Air using Carbon Molecular Sieve Adsorption and GC/MS	13	VOC-AIR, Carbon Molecular Sieve

NOTE: The method number is incorporated into the Parameter Code

REFERENCES:

1. USEPA CLP Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration, OLM03.1, August 1994.
2. NIOSH Manual of Analytical Methods (Second, Part I), NIOSH Monitoring Methods, Volume I.
3. USEPA CLP Statement of Work for Analysis of Polychlorinated Dibenzo-p-Dioxins (PCDD) and Polychlorinated Dibenzofurans (PCDF), DFLM01.0/DFLM01.1 - Rev. 12/90 and Rev. 9/91.
4. Methods for Chemical Analysis of Water and Wastes, Environmental Protection Agency, EPA-600/4-79-020.
5. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, July 1992 and Updates.
6. Method 1613: Tetra- Through Octa- Chlorinated Dioxins and Furans by Isotope Dilutions HRGC/HRMS, EPA 821-B-94-005, October 1994, Rev. B.
7. Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991, and Supplement I, EPA-600/R-94/111, May 1994.
8. Standard Methods for the Examination of Water and Wastewater, 19th Edition, 1995.
9. Methods for the Determination of Organic Compounds in Drinking Water, December 1988, EPA/600/4-88/039 and Updates.
10. Code of Federal Regulations, 40 CFR, Part 136, App. A.
11. American Society for Testing and Materials.
12. USEPA CLP Statement of Work for Inorganics Analysis, Multi-media, Multi-concentration, ILM04.0.
13. EPA Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA-600/4-84-041, May, 1987.

Appendix 3

Data Quality Objectives (DQO) Process Summary

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Data Quality Objective (DQO) Process Summary

DQOs are qualitative and quantitative statements that clearly identify the objective of a proposed project, define the most appropriate type of data to collect, determine the most appropriate conditions for data collection, and specify acceptable decision error limits that establish the quantity and quality of data needed for decision-making.

Note: Do not describe the DQOs by analytical level. In the past, DQOs have mistakenly been described as one to five data quality levels. **These levels are not to be used.** These levels describe analytical methods, not DQOs. For example, Level II field analyses have the potential to produce fully defensible data that can be used to achieve a variety of project-specific DQOs.

The DQO process is a strategic planning approach that is designed to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended application. DQOs provide a systematic procedure for defining the criteria that a data collection design should satisfy, including when to collect samples, where to collect samples, the number of samples to collect, and tolerable levels of decision error.

The DQO process has both quantitative and qualitative statements associated with the data collection activities. The quantitative aspect seeks to use statistics to design the most efficient field investigation that limits the possibility of making an incorrect decision. The qualitative aspect seeks to encourage good planning for field investigations and complements the statistical design.

DQO process outputs, including acceptable limits on decision errors, provide the information necessary to develop field investigations, statistical sampling designs, and sampling and analysis plans (SAPs) for a site. By using the DQO process, the scoping team establishes criteria for determining when data are sufficient for site decisions. This provides a stopping rule—a way for the management team to determine when they have collected enough data. In addition, the DQO process assists the Project Team with establishing an adequate level of data review/validation and documentation.

The DQO process is a valuable tool that offers several advantages. It focuses studies by clarifying vague objectives and limiting the number of decisions that must be made. The process enables data users and technical experts to specify data requirements prior to collection events. It provides a convenient way to document activities and decisions, to communicate the data collection design to others, and to give the data user confidence that the data collected support the decisions concerning remediation and redevelopment of the site. Finally, the DQO process is designed to save resources by streamlining the study process and making data collection operations more resource-effective.

The DQO process, described below in a series of seven sequential steps (see Table A3-1), provides a logical framework for planning multiple field investigations.

Table A3-1. Example: DQO Steps[1] for the Background Groundwater Study

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
STATE THE PROBLEM	IDENTIFY THE DECISIONS	IDENTIFY INPUTS TO THE DECISIONS	DEFINE STUDY BOUNDARIES	DEVELOP DECISION RULES	SPECIFY LIMITS ON DECISION ERRORS	OPTIMIZE SAMPLING DESIGN
• A defensible data set of the background concentrations of naturally occurring metals is needed, in order to perform comparisons of site and background data and determine the amounts of these naturally occurring metals that may have been introduced into the environment as a result of site activities. • Background data may also be used to set realistic cleanup standards for sites that may undergo future remediation.	• Do concentrations of naturally occurring metals in shallow groundwater at the site exceed those of background? • What are realistic cleanup levels for sites that may undergo future remediation?	• Validated defensible chemical data for shallow groundwater from areas not affected by site activities. • Analytical data for metals and water quality parameters in shallow groundwater from background area needs to be compiled and statistically evaluated.	• Groundwater from the shallow aquifer will be sampled and analyzed. The shallow aquifer is unconfined to semi-confined within the study area. • Groundwater samples will be collected from areas predetermined to be located up gradient or side-gradient and away from the sites or far downgradient from sites. • Samples will be collected each quarter for 1 year. Data for all 4 quarters will be composite for statistical analysis.	• If comparison of site and background data sets shows statistically significant differences in the concentrations of the naturally occurring metals, then, pending professional judgment, it may be assumed that site activities have affected the quality of shallow groundwater at the site. • If statistical comparison shows no significant differences, or the results are found not practically significant based on professional judgment, then no remediation of the site is necessary.	• Statistical comparisons of site and background data populations will use a specified significance level, to be agreed to by the regulatory agencies. • Professional judgment will be used to determine practical vs. statistical significance of test results (see EPA 1998).	• Background conditions will be determined for a sample population. Sample size was based on the analysis of existing data for a 90 percent confidence level. • One year of quarterly groundwater samples will be collected from 18 monitoring wells screened in the shallow aquifer and located in background areas.

[1] DQO steps=Data Quality Objective steps, as outlined by EPA. (See U.S. EPA, Guidance for the Data Quality Objectives Process, September 1994 (EPA QA/G-4).

Step 1: Stating the Problem

The first step of any decision-making process is to define the problem that has initiated the study. The goal of this step is to create a well-structured team of technical experts and stakeholders that will work effectively to develop a concise and complete description of the problem, which will provide the basis for the rest of the DQO development.

Identifying members of the scoping team—the group that will develop DQOs for the study—is a critical initial action. Project scoping is perhaps the most critical component of the site assessment process, as it allows team members to fully determine the scope of sampling events. Therefore, it is important that all vested parties (including project managers, engineers, chemists, toxicologists, ecologists, field sampling personnel, and local government officials) be involved in the project from the conceptual design stage, and that all team members have clearly defined roles and responsibilities throughout the project. Roles and responsibilities for the scoping team should be captured in the site-specific QAPP.

The scoping team will collect and evaluate historical site data to develop a conceptual site model. Developing a site model means that the Project Team can generally reconstruct what went on at the site and how chemicals were used and disposed of. The conceptual site model will identify the relationships between types and concentrations of contamination, locations where contamination or contamination/waste sources exist, potentially contaminated media and migration pathways, and potential physical and environmental targets or receptors. Information gathered from the conceptual site model is used to define site conditions that indicate or could lead to an unacceptable threat or exposure at the site.

The scoping team should follow each step of the DQO process for each medium (e.g., soil, groundwater) of concern. Therefore, it is important, if possible, that the scoping team include representatives knowledgeable in quality assurance, sampling techniques, statistical modeling, technical project management, human health and ecological risk assessments, chemistry, toxicology, biology, ecology, data management, and natural resource management. Once the scoping team has gone through the process completely for one medium, it becomes easier and quicker to develop additional sets of DQOs for other media.

Stating the problem typically involves developing a concise description of the problem to be addressed. The problem statement should include the regulatory and programmatic context of the problem, such as the regulatory objectives and basis for the field investigation. The statement should include a description of the source and/or location of contamination, such as physical and chemical factors associated with the site that could result in contaminant release or unacceptable exposures. The problem statement also should include appropriate action levels for evaluating and responding to releases or exposures and appropriate response actions.

Finally, the problem statement should specify available resources and relevant deadlines for the study. This description should include the anticipated budget, available personnel, and contractual

vehicles (if applicable). A timeline should be developed that shows deadlines for completion of the study and any intermediate deadlines that may need to be met.

Step 2: Identifying the Decisions

The decisions that must be made in order to achieve the stated goal include:

- Delineating the nature and extent of contamination, and
- Identifying potential remedial options.

The first step is to define the question that the study will attempt to resolve and identify the alternative actions that may be taken based on the outcome of the study. The combination of these two elements is called the decision statement and is critical for defining decision performance criteria later in the DQO process. The principal study question should be stated as specifically as possible. Alternative actions, including the no-action-required alternative, should also be clearly defined, as these will form the basis for defining decision performance criteria later in the process (see Step 6, Specifying Limits on Decision Errors").

The decision statement should express a choice among alternative actions. A suggested format is "Determine whether or not [unknown environmental conditions/criteria from the principal study question] require/support [taking alternative actions]." If several such decisions will be made, each decision should be identified and a relationship established among them that also indicates the order of priority.

Step 3: Identifying Inputs to the Decisions

The scoping team must identify the different types of information that will be needed to resolve the decision statement. For example, it is important to determine whether monitoring, modeling, or a combination of these approaches will be used to support the decision, as each approach requires specific inputs.

Sources may already exist that can help the Project Team, including historical records, regulations, directives, engineering standards, scientific standards, scientific literature, previous site field investigations, or professional judgments. All existing data should be qualitatively evaluated to determine if they are appropriate for the study.

Next, the team must define the action levels, or threshold values, that provide the criteria for choosing among alternative actions. Regulatory thresholds or standards usually form the basis for action levels. If no regulatory threshold or standard can be identified for site contaminants during this step, the scoping team needs to identify information that will help develop a realistic goal to serve as a contaminant action level for the field investigation design and evaluation. The final numerical value for the action level is determined as part of Step 5, Developing a Decision Rule, and Step 7, Optimize the Sampling Design, which will determine which analytical method will be used.

The outputs for Step3 include a list of the informational inputs needed to make the decisions (identified in Step 2) and a list of environmental variables or characteristics that will be measured. In essence, the outputs of this step are actually the inputs to the decisions that need to be made.

Step 4: Defining the Study Boundaries

Study boundaries refers to both spatial and temporal boundaries. For samples to be representative of the area for which the decision will be made, the boundaries of the study must be precisely defined. Practical constraints that could interfere with sampling are also identified in this step. A practical constraint can be any obstacle that may interfere with the full implementation of the study design.

To define the spatial boundaries of the decisions, the geographic area within which all decisions apply must be identified. Examples of spatial boundaries are property boundaries and potential exposure areas. Along with the identified geographic area, the total collection area from which samples will be drawn, referred to as "population," also needs to be identified. For example, soil sampling boundaries may include the population of the "surface or top 12 inches of soil, and the subsurface soil (soil from 12 to 24 inches deep) taken from the southwest corner of the property where the chemical storage shed was once located."

The scale of decision-making is the smallest area, volume, or timeframe of the media for which the scoping team wishes to control decision errors. The size may range from the geographic boundaries of the site to the smallest area that presents an exposure to the receptor (the chemical storage area in the previous example).

The temporal boundaries of the decision also should be defined. It may not be possible to collect data over the full time period to which the decision will apply. For example, a study to measure exposure to volatile organic compounds from a contaminated site may give misleading information if the sampling is conducted in the colder winter months rather than the warmer summer months. The scoping team would therefore have to determine the most appropriate period for gathering data that will reflect the conditions that are of interest.

Practical constraints on data collection also need to be recognized. These constraints include meteorological conditions that make sampling impossible; the inability to gain site access or informed consent; or the unavailability of personnel, time, or equipment.

Step 5: Developing a Decision Rule

The purpose of developing a decision rule is to integrate the output from the previous steps of the DQO process into a statement that defines the parameter of interest; delineates the scale of decision-making; specifies the action level; and describes the logical basis for choosing among alternative actions.

The action level is the contaminant threshold that, if exceeded, would indicate that the management team must select among the alternative actions identified earlier in the process. If the decision-maker believes that the final remediation level could be one of two different levels, then the more stringent one should be chosen for the action level.

The output for this step is to develop an "If . . . then . . . " statement that defines the conditions that would cause the decision-maker to choose among alternative courses of action. For example, "If the [parameter of interest] within the [scale of decision-making] is greater than [the action level], then select [alternative action A]; otherwise select [alternative action B]."

For example, the assessment identified an area that was previously used as a chemical storage shed. Manifests indicate that large quantities of highly toxic solvents were stored in the structure. There is a need to determine if any of the chemicals were absorbed into the soil below and how deeply. It is also known that the State has a lower cleanup level than EPA. The decision rules could be, "If the soil has concentrations of solvents greater than the State cleanup level at 1 to 2 feet, then the chemical storage area must be cleaned to State levels down to 2 feet." This is the most conservative decision rule and allows for additional decisions to be made for the top 12 inches of soil, as well as comparison against the EPA standard.

Step 6: Specifying Limits on Decision Errors

The sampling process is not an exact representation of the site's characteristics; rather, it is an estimate of the site's condition. Because of the inexact nature of sampling, decisions could be made that are based on inaccurate measurement data. Acceptable limits on the probability of making a decision error should be developed. These limits are incorporated into the sampling and analysis plan for site assessment.

The true value of an environmental measurement can be in question as a result of a sampling error. Sampling errors can occur when sampling is unable to capture the complete scope of natural variability that exists in the environment. Data may also be questionable due to measurement errors. Measurement errors can happen during sample collection, handling, preparation, analysis, data reduction, or data handling. A combination of sampling and measurement error is called a total study error.

Data may often be suspect or questionable; however, corrective steps can be taken or additional qualifying information can be collected that will allow the full or limited use of the data. These are called corrective actions, and some forethought should be given to determining corrective action scenarios during this step.

Step 7: Optimizing the Sampling Design

The purpose of this step is to identify the most resource-effective sampling design for generating data that also satisfies the DQOs specified in the preceding steps. In most cases, this step involves deciding the type and number of samples necessary to characterize a site or an area of the site. Most

field investigations will require a probabilistic sampling approach that uses analytical results from a few samples to estimate the contamination on the entire site. The scoping team is expected to balance site assessment sampling with such resources as funding, personnel, and temporal constraints while still meeting the DQOs. In the chemical storage example, soil screening methods may be used to determine "hot spots," the locations within the study area where the highest concentrations of chemicals are expected.

For some field investigations, a nonprobabilistic or judgmental sampling approach is acceptable. Typically, this occurs when a scoping team wants to confirm the existence of contamination at specific locations, based on historical or visual information.

The scoping team should review the outcomes of the previous DQO process steps to determine exactly how the limits on decision errors will prescribe the number and location of samples to be collected and the types of analyses per sample. Using these DQO outputs, the scoping team can then confirm the budget for sampling and analysis and the project schedule.

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Appendix 4

Examples of Field Sampling Forms

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AQUIFER TEST DATA

Owner ______________________ Address ______________________ County ______________ State __________

Date ______________ Company performing test ______________________ Measured by ______________

Well No. ______________ Distance from pumping well __________ Type of test ______________________ Test No. __________

Measuring equipment ____

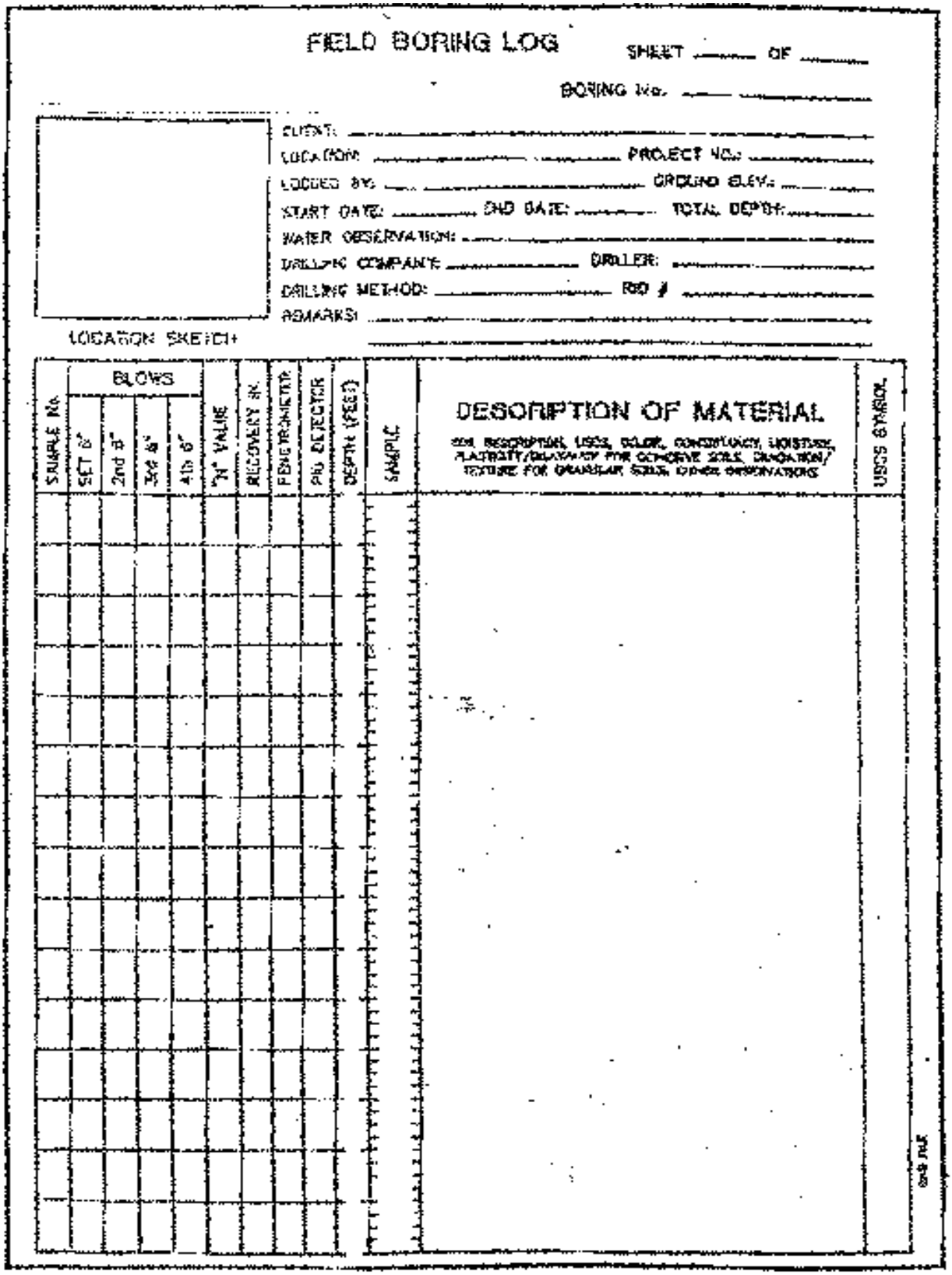
Time Data
Pump on: Date ______ Time ______ (t_0)
Pump off: Date ______ Time ______ (t'_0)
Duration of aquifer test:
Pumping ______ Recovery ______

Water Level Data
Static water level ______
Measuring point ______
Elevation of measuring point ______

Discharge Data
How Q measured ______
Depth of pump/air line ______
Previous pumping? Yes ____ No ____
Duration ______ End ______

Comments on factors affecting test data

Date	Clock time	Time since pump started t	Time since pump stopped t'	t/t'		Water level measurement	Correction or Conversion	Water level	Water level change s or s'		Discharge measurement	Rate		Comments on factors affecting test data



FIELD BORING LOG

SHEET ____ OF ____

BORING No. ____

CLIENT: ____

LOCATION: ____ PROJECT NO.: ____

LOGGED BY: ____ GROUND ELEV.: ____

START DATE: ____ END DATE: ____ TOTAL DEPTH: ____

WATER OBSERVATION: ____

DRILLING COMPANY: ____ DRILLER: ____

DRILLING METHOD: ____ RIG #: ____

REMARKS: ____

LOCATION SKETCH:

SAMPLE No.	BLOWS: SET 0"	BLOWS: 2nd 6"	BLOWS: 3rd 6"	BLOWS: 4th 6"	"N" VALUE	RECOVERY IN.	PENETROMETER	PID DETECTOR	DEPTH (FEET)	SAMPLE	DESCRIPTION OF MATERIAL (SOIL DESCRIPTION, USCS, COLOR, CONSISTENCY, MOISTURE, PLASTICITY/DILATANCY FOR COHESIVE SOILS, CEMENTATION/ STRUCTURE FOR GRANULAR SOILS, OTHER OBSERVATIONS)	USCS SYMBOL

INCREMENTAL FIELD MEASUREMENTS

Site _____

Date _____

Volume Removed 1) 2) 3) 4) _____

Time 1) 2) 3) 4) _____

Well No. _____

Performed by _____

Specific Conductance	Trial No. 1	Trial No. 2	Trial No. 3	Trial No. 4
Temperature °C				
Ucorrected (µmhos/cm)				
Correction Factor				
Specific Conductance Corrected (µmhos/cm)				

pH

Initial sample pH reading:

1) pH calibration on _____ standard: 4 = _____ 7 = _____ 10 = _____

2) _____ standard: 4 = _____ 7 = _____ 10 = _____

3) _____ standard: 4 = _____ 7 = _____ 10 = _____

4) _____ standard: 4 = _____ 7 = _____ 10 = _____

	Trial No. 1	Trial No. 2	Trial No. 3	Trial No. 4
In-Situ Temperature				
Sample pH				

1) pH recheck 4 = _____ 7 = _____ 10 = _____

2) 4 = _____ 7 = _____ 10 = _____

3) 4 = _____ 7 = _____ 10 = _____

4) 4 = _____ 7 = _____ 10 = _____

GEOLOGIC LOG

PROJECT: _____ JOB NUMBER: _____

LOCATION: _____

BOREHOLE/WELL NUMBER: _____

DATE LOGGED: _____

DEPTH	NUMBER	INTERVAL AND TYPE	ADVANCED/ RECOVERED	BLOW COUNTS PER 6 INCHES	WATER TABLE	SAMPLE DESCRIPTION (SOIL OR ROCK TYPE, COLOR, GRAIN SIZE, SORTING, ROUNDNESS, PLASTICITY, MOISTURE CONTENT, TRACE MATERIALS, ODOR, STAINING, TRACE GAS READINGS)

GEOLOGIST'S SIGNATURE

PAGE _____ OF _____

GROUNDWATER SAMPLE DATA SHEET

Project _____ Date _____

Project Number _____ Location _____ Well Number _____

Quarterly Event _____ Sample Number _____

Field Personnel _____

Purging Method _____

Sampling Method _____

Initial Water Level (ft TOIC) _____ Time _____

Total Depth of Well (ft TOIC) _____

Diameter of Well (feet) _____

Length of Water Column (feet) _____

One Well Volume (gallons) _____

Time Began Evacuation _____ Time Completed Evacuation _____

Evacuation Method _____

Volume Removed (gallons) _____

Time Began Sampling _____ Time Completed Sampling _____

Sampling Method _____

Field Analysis:

Temperature (°C)	_____	_____	_____	_____	_____
Conductivity (umhos/cm)	_____	_____	_____	_____	_____
pH	_____	_____	_____	_____	_____
Odor	_____	_____	_____	_____	_____
Turbidity (NTUs)	_____	_____	_____	_____	_____
Visual Clarity	_____	_____	_____	_____	_____
Color	_____	_____	_____	_____	_____
Other	_____	_____	_____	_____	_____

To calculate borehole volume:

Inner Diameter of Well Casing (ft) = D_1 _____ Total Depth of Well (ft) _____

One Well Casing Volume = 7.48 gal/ft^3 x ($\pi(D_1/2)^2 H_1$) Height of Water Column in Well (ft) = H_1 _____

Remarks/Samples Obtained: analysis, sample quantity (bottles used), preservative

WELL PURGING AND GROUNDWATER SAMPLE DATA SHEET

Project _____ Date _____

Project Number _____ Location _____ Well Number _____

Quarterly Event _____ Sample Number _____

Initial Water Level (ft TOIC) _____ Time _____

Total Depth of Well (ft TOIC) _____ One Well Volume (gals) _____

Field Personnel _____

Development/Purging Method _____

Sampling Method _____

WITHDRAWAL OF WELL VOLUMES

Time					
Volume Purged (gallons)					
Temperature (°C)					
Conductivity (umhos)					
pH					
Odor					
Turbidity (NTUs)					
Visual Clarity					
Color					
Other					
Time					
Volume Purged (gallons)					
Temperature (°C)					
Conductivity (umhos)					
pH					
Odor					
Turbidity (NTUs)					
Visual Clarity					
Color					
Other					

To calculate well volume:

Inner Diameter of Well Casing (ft) = D_1 _____ Total Depth of Well (ft) _____

One Well Casing Volume = 7.48 gal/ft^3 x ($\pi(D_1/2)^2 H_1$) Height of Water Column in Well (ft) = H_1 _____

Remarks/Samples Obtained: analysis, sample quantity (bottles used), preservative

Well Completion Report

Site #: _____ County: _____ Well #: _____

Site Name: _____ Grid Coordinates: Northing _____ Easting _____

Drilling Contractor: _____ Date Drilled Start: _____

Driller: _____ Geologist: _____ Date Completed: _____

Drilling Method: _____ Drilling Fluid (type): _____

Annular Space Details

Type of Surface Seal: _____

Type of Annular Sealant: _____

Amount of Cement: # of bags _____ Lbs. per bag _____

Amount of Bentonite: # of bags _____ Lbs. per bag _____

Type of Bentonite Seal (Granular, Pellet) _____

Amount of Bentonite: # of bags _____ Lbs. per bag _____

Type of sand Pack: _____

Source of Sand: _____

Amount of Sand: # of bags _____ Lbs. per bag _____

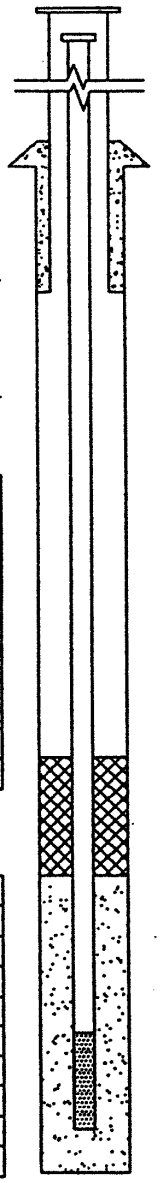
Well Construction Materials

	Stainless Steel Specify Type	Teflon Specify Type	PVC Specify Type	Other Specify Type
Riser coupling joint				
Riser pipe above w.t.				
Riser pipe below w.t.				
Screen				
Coupling joint screen to riser				
Protective casing				

Measurements

to 0.01ft. (where applicable)

Riser pipe length	
Protective casing length	
Screen length	
Bottom of screen to end cap	
Top of screen to first joint	
Total length of casing	
Screen slot size	
# of openings in screen	
Diameter of borehole (in)	
ID of riser pipe (in)	



Elevations - .01 ft.

____ ____ MSL Top of Protective Casing

____ ____ MSL Top of Riser Pipe

____ ____ ft. Casing Stickup

____ ____ MSL Ground Surface

____ ____ MSL Top of Annular Seelant

____ ____ ft. Top of Seal

____ ____ ft. Total Seal Interval

____ ____ ft. Top of Sand

____ ____ ft. Top of Screen

____ ____ ft. Total Screen Interval

____ ____ ft. Bottom of Screen

____ ____ ft. Bottom of Borehole

Completed by: _____ Surveyed by: _____ Ill. regestration #: _____

WELL DATA SHEET

Date: Beg._____ End_____

Site Name_____

Well No./Location_____ Job No._____

1. Well Information[1]
   - Inner Casing Diameter_____
   - Outer Casing Diameter_____
   - Outer Casing Height_____
   - ΔOuter Casing/Inner Casing_____
   - [2]Inner Casing Height_____
   - Total Depth (from TIC)_____
   - DTW (from TIC)_____
   - Water Column Length_____
   - Casing Volume_____
   - x 3_____
   - DTW Time_____
   - Date_____
   - Personnel_____

2. General Observations
   - Organic Vapors (HNu, OVA, TIP)_____
   - Reading: Breathing Zone_____
   - Reading: Water/Air Interface_____
   - Radation_____
   - Sediment_____
   - Color_____
   - Odor_____

3. Purge Methods
   - Date_____
   - Time: Begin_____ End_____
   - Equipment_____
   - Personnel_____
   - Volume Removed_____
   - Disposition of Purge Water_____
   - Equipment_____

4. Sample Methods
   - Date_____
   - Time: Begin_____ End_____
   - Personnel_____
   - Equipment_____
   - Lot #_____

5. Notes
   - Facility Well Security_____
   - Dedicated Equipment_____
   - Casing Material_____
   - Nonaqueous Phases_____
   - Product Width_____
   - Sampling Ambient Conditions (weather,etc.)_____
   - Other_____

[1]All length measurements to .01 foot.
[2]Above ground or below surfaces; use negative number for below surface.

WELL DEVELOPMENT DATA SHEET

Project:	Date:	Page:	Of:
Project Number:	Well Number:		
Diameter of Well:	Length of Water Column:		
Depth of Well:	One Well Volume:		
Initial Water Level:	Time:		
Field Personnel:			
Development Method:			

WITHDRAWL OF WELL VOLUMES

CATEGORY	Volume 1	Volume 2	Volume 3	Volume 4	Volume 5	Volume 6
Time End Flushing						
Volume Flushed (gal)						
Temperature (C°)						
Conductivity (mS)						
pH						
Odor						
Water Quality						
Color						
Other:						

CATEGORY	Volume 7	Volume 8	Volume 9	Volume 10	Volume 11	Volume 12
Time End Flushing						
Volume Flushed						
Temperature						
Conductivity						
pH						
Odor						
Water Quality						
Color						
Other:						

Well Casting Volumes - (GAL/FT)	Remarks
1¼" = 0.077 1½" = 0.10 2" = 0.164 2½" = 0.24 3" = 0.37 3½" = 0.50 4" = 0.65 6" = 1.46	

WELL DEVELOPMENT LOG

Project _____ Date _____

Project Number _____ Well Number _____

Initial Water Level (ft TOIC) _____ Time _____

Total Depth of Well (ft TOIC) _____ One Well Volume (gals)

Length of Water Column (ft) _____ _____

Field Personnel _____

Development Method _____

WITHDRAWAL OF WELL VOLUMES

Time					
Volume Purged (gallons)					
Temperature (°C)					
Conductivity (umhos)					
pH					
Odor					
Turbidity					
Color					
Other					
Time					
Volume Purged (gallons)					
Temperature (°C)					
Conductivity (umhos)					
pH					
Odor					
Turbidity					
Color					
Other					

To calculate well volume:

Inner Diameter of Well Casing (ft) = D_1 _____ Total Depth of Well (ft) _____

One Well Casing Volume = 7.48 gal/ft^3 x ($\pi(D_1/2)^2 H_1$) Height of Water Column in Well (ft) = H_1 _____

Remarks/Samples Obtained: analysis, sample quantity (bottles used), preservative

CHAIN OF CUSTODY RECORD

PROJECT NO.	PROJECT NAME					PARAMETERS									
SAMPLERS: *(Signature)*					(Printed)										
FIELD SAMPLE NUMBER	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS									REMARKS

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
(Printed)		(Printed)	(Printed)		(Printed)
Relinquished by: *(Signature)*	**Date / Time**	**Received for Laboratory by:** *(Signature)*	**Date / Time**	**Remarks**	
(Printed)		(Printed)			

Distribution: Original Plus One Accompanies Shipment (white and yellow); Copy to Coordinator Field Files (pink).

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Appendix 5

Environmental Monitoring Management Council (EMMC) Method Format

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EMMC METHODS FORMAT

This document describes the standard to be used to document EPA's environmental monitoring methods. The *EMMC Methods Format* was developed to provide a uniform system for the integrated review of methods by the Work Groups of the Environmental Monitoring Management Council's *Ad Hoc* Panel on Methods Integration. The outline form of the *Methods Format* was approved by the EMMC Methods Integration Panel and Chairs of the respective Work Groups on January 24, 1992. While the format originally was intended for use in documenting methods for use across the various EPA Program Offices, some of the specifics in this description relate to the special problems of documenting a performance-based method. The bold text indicates the numbers and titles of the sections specified in the EMMC format.

1.0 Scope and Application

- Tabular format whenever possible
- Analyte list
- CAS numbers
- Matrices
- Method Sensitivity (expressed as mass and as concentration with a specific sample size)

Include a list of analytes (by common name) and their CAS registry numbers, the matrices to which the method applies, a generic description of method sensitivity (expressed both as the mass of analyte that can be quantified and as the concentration for a specific sample volume or size), and the data quality objectives which the method is designed to meet. Much of this material may be presented in a tabular format.

2.0 Summary of Method

- Sample volume requirements,
- Extraction,
- Digestion,
- Concentration, and other preparation steps employed,
- Analytical instrumentation and detector system(s), and
- Techniques used for quantified determinations.

Summarize the method in a few paragraphs. The purpose of the summary is to provide a succinct overview of the technique to aid the reviewer or data user in evaluating the method and the data. List sample volume, extraction, digestion, concentration, and other

preparation steps employed, the analytical instrumentation and detector systems(s), and the techniques used for quantitative determinations.

3.0 Definitions

Include the definitions of all method-specific terms, here. For extensive lists of definitions, this section may simply refer to a glossary attached at the end of the method document.

4.0 Interferences

This section should discuss any known interferences, especially those that are specific to the performance-based method. If known interferences in the reference method are not interferences in the performance-based method, this should be clearly stated.

5.0 Safety

- Above and beyond good laboratory practices
- Disclaimer statement (look at ASTM disclaimer)
- Special precautions
- Specific toxicity of target analytes or reagents
- Not appropriate for general safety statements

This section should discuss only those safety issues specific to the method, and beyond the scope of routine laboratory practices. Target analytes or reagents that pose specific toxicity or safety issues should be addressed in this section.

6.0 Equipment and Supplies

Use generic language wherever possible. However, for specific equipment such as GC (gas chromatograph) columns, do not assume equivalency of equipment that was not specifically evaluated, and clearly state what equipment and supplies were tested.

7.0 Reagents and Standards

Provide sufficient details on the concentration and preparation of reagents and standards to allow the work to be duplicated, but avoid lengthy discussions of common procedures.

8.0 Sample Collection, Preservation and Storage

- Provide information on sample collection, preservation shipment and storage conditions
- Holding times, if evaluated

If effects of holding time were specifically evaluated provide reference to relevant dam; otherwise, do not establish specific holding times.

9.0 Quality Control

Describe specific quality control steps, including such procedures as method blanks, laboratory control samples, QC check samples instrument checks, etc., defining all terms in section 3.0. Include frequencies for each such QC operation.

10.0 Calibration and Standardization

Discuss initial calibration procedures here. Indicate frequency of such calibrations, refer to performance specifications, and indicate corrective actions that must be taken when performance specifications are not met. This section may also include procedures for calibration verification or continuing calibration, or these steps may be included in section 11.0.

11.0 Procedure

Provide a general description of the sample processing and instrumental analysis steps. Discuss those steps that are essential to the process, and avoid unnecessarily restrictive instructions.

12.0 Data Analysis and Calculations

Describe qualitative and quantitative aspects of the method. List identification criteria used. Provide equations used to derive final sample results form typical instrument data. Provide discussion of estimating detection limits, if appropriate.

13.0 Method Performance

- A precision/bias statement should be incorporated in the section, including
- detection limits, and
- source/limitations of data

Provide detailed description of method performance, including data on precision, bias, detection limits (including the method by which they were determined and matrices to which they apply), statistical procedures used to develop performance specifications etc. Where performance is tested relative to the reference method, provide a side-by-side comparisons of performance versus reference method specifications.

14.0 Pollution Prevention

Describe aspects of this method that minimize or prevent pollution that may be attributable to the reference method.

15.0 Waste Management

Cite how waste and samples are minimized and properly disposed.

16.0 References

- Source documents
- Publications

17.0 Tables, Diagrams, Flowcharts, and Validation Data

Additional information way be presented at the end of ft method. Lengthy tables may be included here, and referred to elsewhere in the text by number. Diagrams should only include new or unusual equipment or aspects of the method.

Appendix 6

Example Questionnaire and Example NELAC Audit Report

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NELAC Material
(Reserve)

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Appendix 7

Example: Overall Evaluation of Data

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Data Validation Worksheet
Overall Evaluation of Data - Data Validation Memorandum - Table II

VOLATILE ORGANICS					
DQO (list all DQOs)	**Sampling and/or Analytical Method Appropriate Yes or No**	**Measurement Error**		**Sampling Variability****	**Potential Usability Issues**
		Analytical Error	**Sampling Error***		
• Ecological Risk Assessment • Source Identification • Surface waters collected from this site were found to have the following contaminants: benzene, trichloroethene, tetrachloroethene, 1,2-dichloroethene, and 1,1,2,2-tetrachloroethane. Are the site soils a source of contamination?	Yes, sampling and analytical method, CLP SOW OLM03.2, appropriate for samples: SAA09, SAA12, SAA13, SAA14 No, sampling and/or analytical method, CLP SOW OLM03.2, inappropriate for samples: SAA10, SAA11	Refer to qualifications in R/S Key: $J^{1,4}$ $R^{1,2,5}$	Refer to qualifications in R/S Key: $J^{2,3,5}$ $R^{3,4}$		• Poor field duplicate precision indicates a problem in obtaining representative data, limiting the achievement of DQOs. • All tetrachloroethene non-detects are rejected in all volatile soil/sediment samples due to low bias of PE result and possibility of false negatives. All tetrachloroethene positive detects are potentially biased low. • All volatile non-detects are rejected in SAA10 due to low percent solids and all positive detects are estimated. • All volatile results are rejected in SAA11 due to extremely low percent solids. • All non-detects quantitated against bromochloromethane in volatile sample SAA14 are rejected as unusable due to poor IS recoveries and the possibility of false negatives. • All non-detects in SAA09 are rejected due to improper sample preservation and storage by the laboratory.

* The evaluation of "sampling error" cannot be completely assessed in data validation.

** Sampling variability is not assessed in data validation.

Validator: *M. Howard* Date: 5/20/97

Data Validation Worksheet
Overall Evaluation of Data - Data Validation Memorandum - Table II

SEMIVOLATILE ORGANICS					
DQO (list all DQOs)	**Sampling and/or Analytical Method Appropriate Yes or No**	**Measurement Error**		**Sampling Variability****	**Potential Usability Issues**
		Analytical Error	**Sampling Error***		
• Ecological Risk Assessment • Source Identification • Surface waters collected from this site were found to have the following contaminants: 1,2-dichlorobenzene, 1,2,4-trichlorobenzene, 1,4-dichlorobenzene. Are the site soils a source of contamination?	Yes, sampling and analytical method, CLP SOW OLM03.2, appropriate for samples: SAA09, SAA12, SAA13, SAA14 No, sampling and/or analytical method, CLP SOW OLM03.2, inappropriate for samples: SAA10, SAA11	Refer to qualifications in R/S Key: $J^{1,2,3,7}$ $R^{1,2}$	Refer to qualifications in R/S Key: $J^{4,5,6}$ $R^{3,4}$		• Poor field duplicate precision indicates a problem in obtaining representative data, limiting the achievement of DQOs. • 1,2-dichlorobenzene and 1,3-dichlorobenzene non-detects are rejected due to the possibility of false negatives and 1,4-dichlorobenzene positive detects are estimated in semivolatile samples SAA13 & SAA14 due to potential low bias indicated by low surrogate recoveries. • All semivolatile non-detects are rejected in SAA10 due to low percent solids and all positive results are estimated. • All semivolatile results are rejected in SAA11 due to extremely low percent solids. • Benzo[a]pyrene non-detects are rejected in semivolatile samples SAA09, SAA11, & SAA12 due to lack of instrument stability and the possibility of false negatives. Benzo[a]pyrene positive detects are estimated in semivolatile samples SAA10, SAA13, & SAA14 due to lack of instrument stability and potential low bias.

* The evaluation of "sampling error" cannot be completely assessed in data validation.

** Sampling variability is not assessed in data validation.

Validator: *M. Howard* Date: 5/20/97